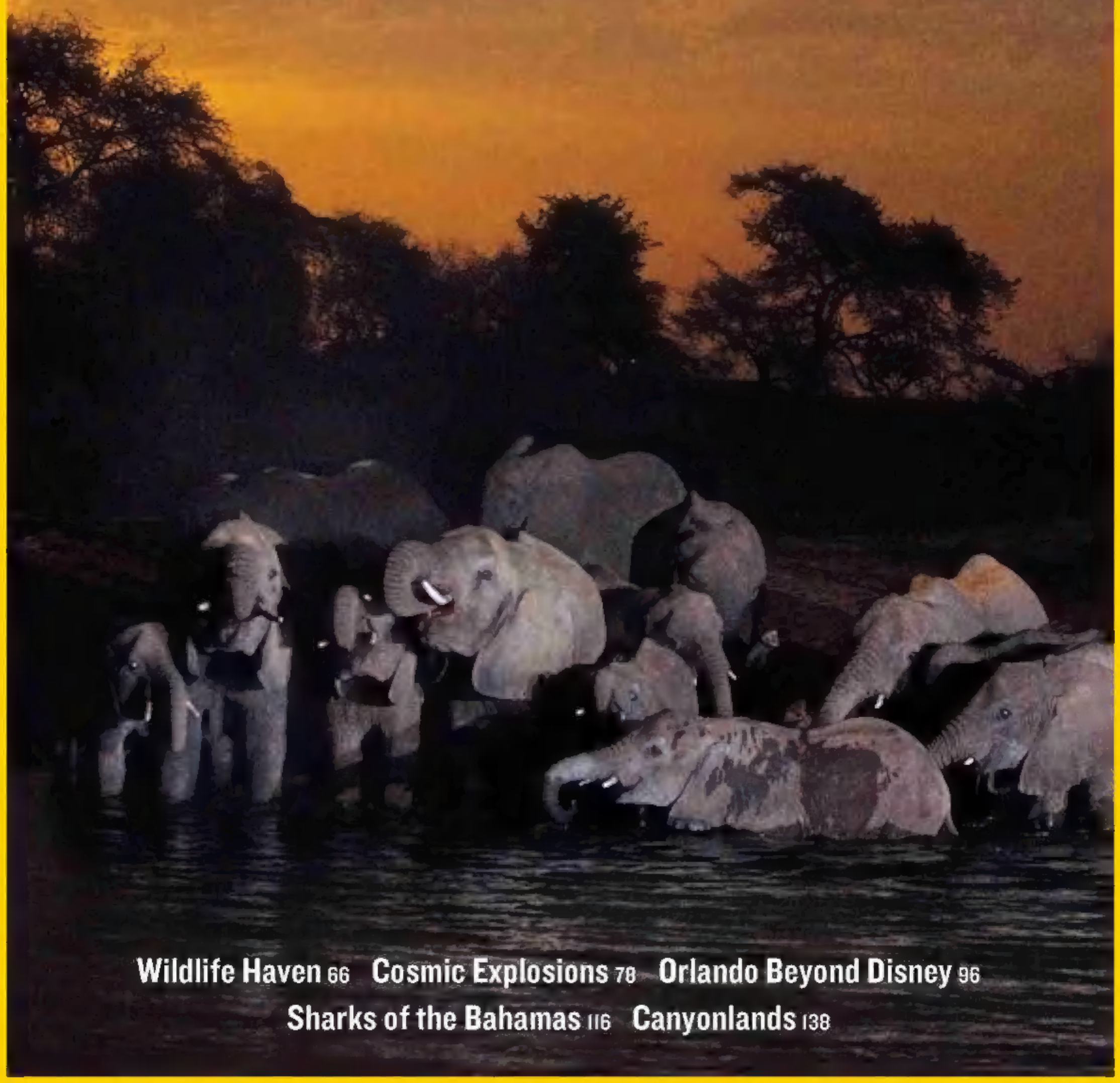
NATIONALGEOGRAPHIC.COM/MAGAZINE MARCH 2007

NATIONAL GEOGRAPHIC

Defending a Forgotten Herd



Things to do while you're alive:

- ☐ Go to the Super Bowl
- ☐ See a Broadway show, front-row center
- ☐ Go to the Olympic Games
- ☐ Ski the first tracks at Deer Valley
- ☐ Try to hit a major-league fastball
- ☐ Stay at a five-star hotel and upgrade your room
- ☐ See the Northern Lights
- ☐ Take a train ride on the Orient Express
- ☐ Go to the Galapagos Islands
- ☐ Ride a motorcycle across the U.S.
- ☐ Help dig for dinosaur bones
- ☐ Float along the Nile
- ☐ Own a set of Frette linens
- ☐ Volunteer to help save the environment
- ☐ Climb Mount Olympus
- ☐ Watch the Sumo Wrestling Championship in Japan
- ☐ Ride a mule through the Grand Canyon
- ☐ Train like an astronaut at space camp
- ☐ Fly across the Atlantic in a private jet
- ☐ Have Gospel Brunch at the House of Blues
- ☐ Get a spa treatment that requires a team
- ☐ Go to the end of the earth

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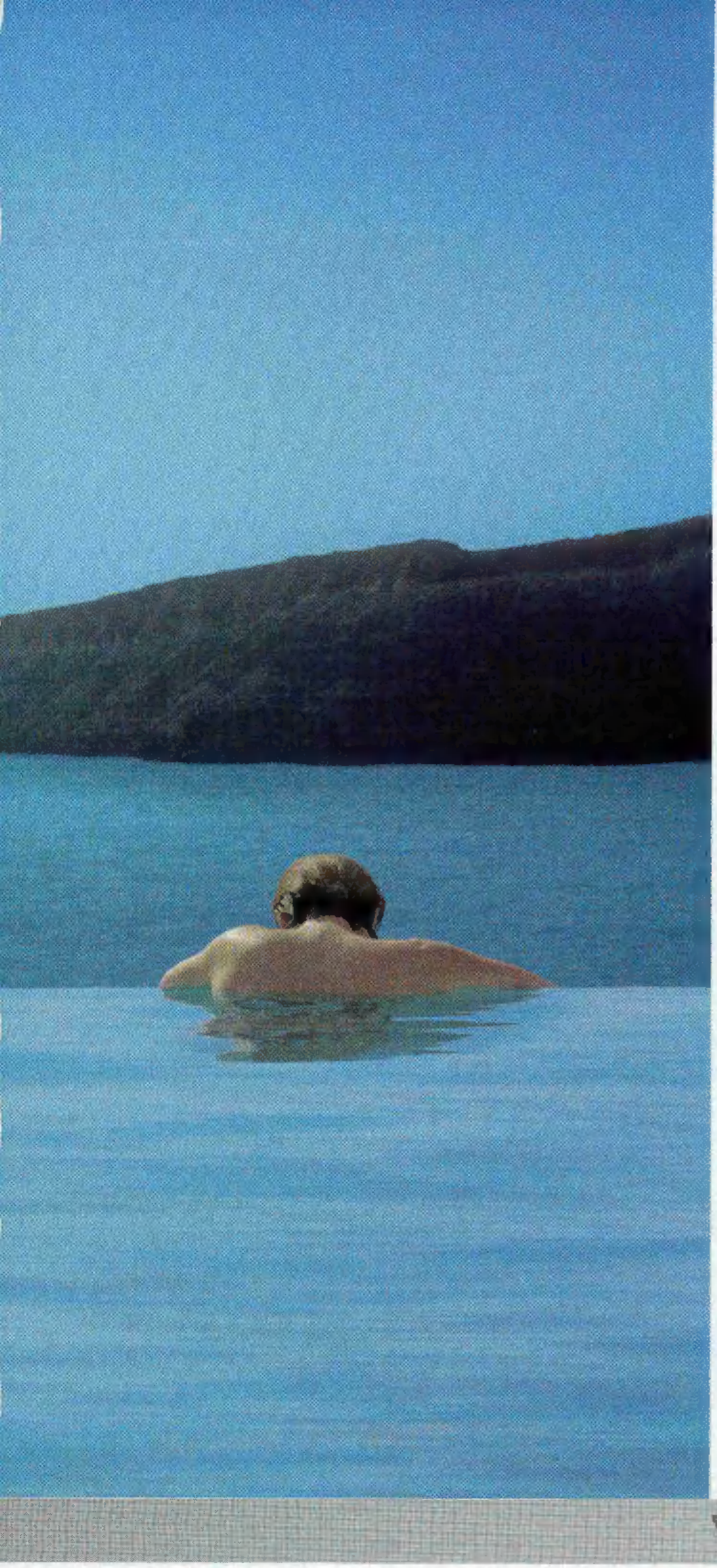

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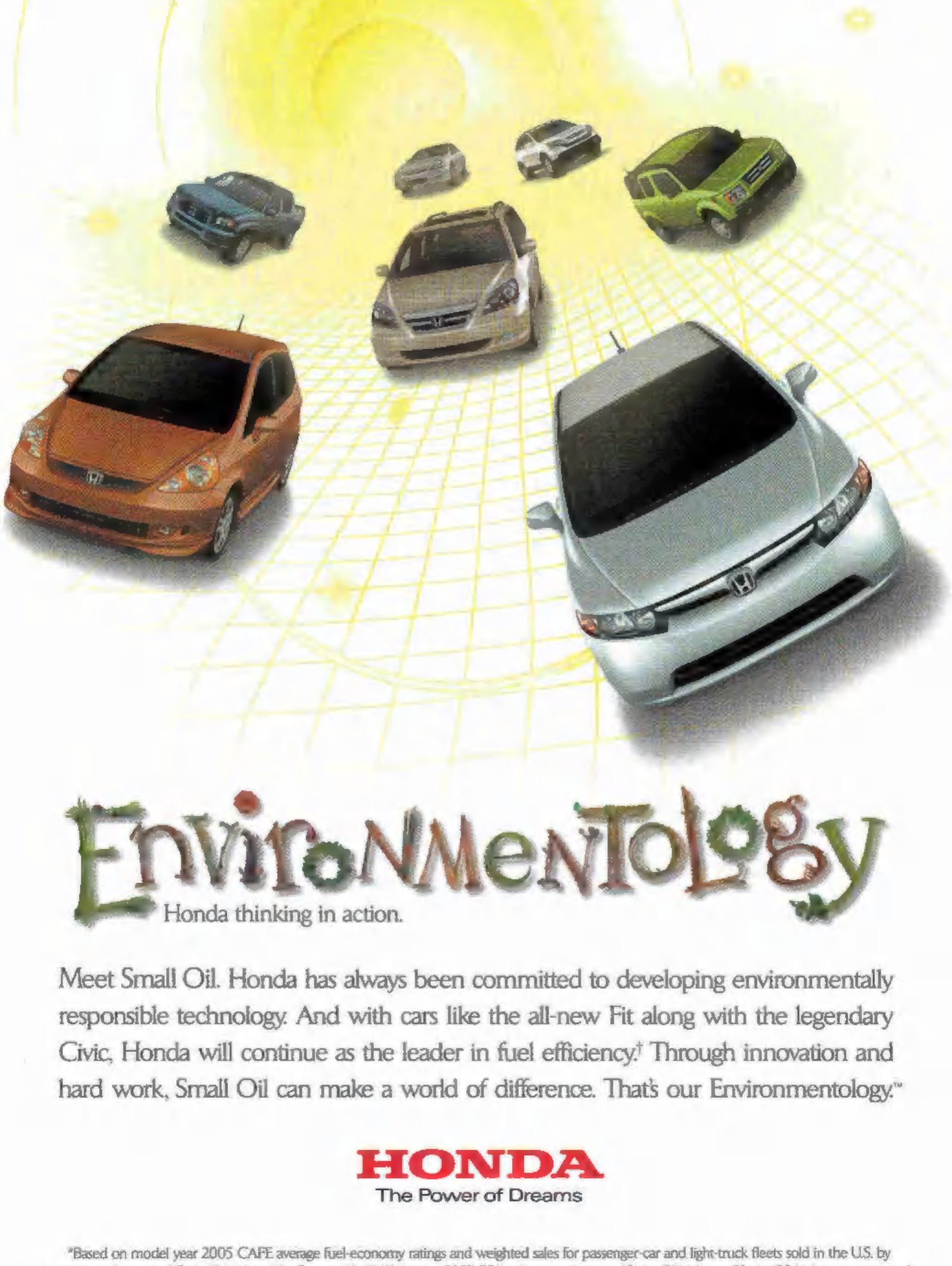

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*Based on model year 2005 CAFE average fuel-economy ratings and weighted sales for passenger-car and light-truck fleets sold in the U.S. by major manufacturers. †Civic Hybrid and Fit Sport with 5MT shown. 2007 EPA mileage estimates: 49 city/51 highway, 33 city/38 highway, respectively. Use for comparison purposes only. Actual mileage may vary. environmentology.honda.com

NATIONAL GEOGRAPHIC

MARCH 2007 • VOL. 211 • NO. 3

Dancers pause in an Orlando, Florida, park after the diverse city's annual Puerto Rican Day parade. See story on page 96.

DAVID BURNETT

Features

COVER Elephants gather at a water hole in Zakouma National Park in Chad. **PHOTO BY MICHAEL NICHOLS**

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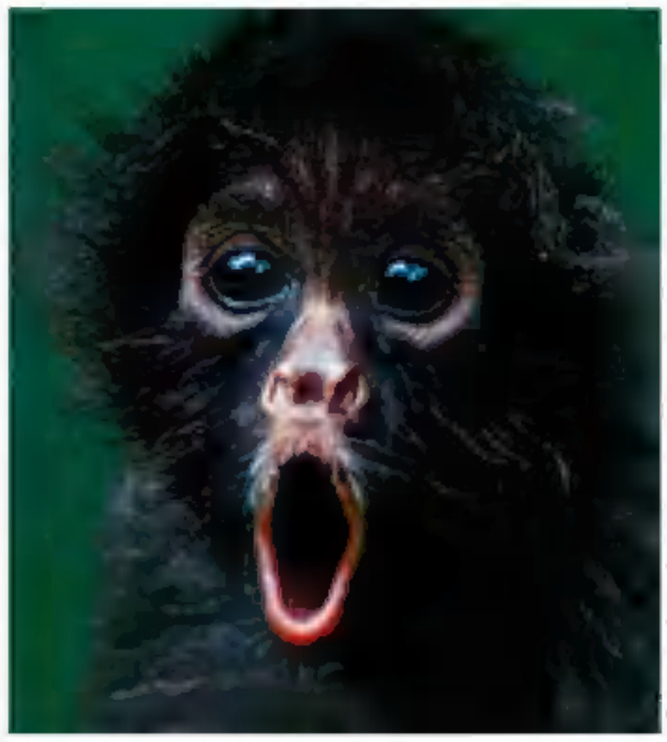
OFFICIAL JOURNAL OF THE NATIONAL GEOGRAPHIC SOCIETY

Whooping Crane Migration

Grapefruit's Dark Side



Stolen Zoo Animals

On the Web

ngm.com/0703

Zakouma National Park
See more of photographer Michael Nichols's visions of wildlife in our Photo Gallery.

Great Sharks
Find out from photographer Brian Skerry what it's like to swim with the sharks and why the predators have such an image problem.

Cosmic Explosions
Beyond the calm of a starry night visible to the naked eye, deep space churns with unimaginable violence. See compelling images of stars in their death throes.

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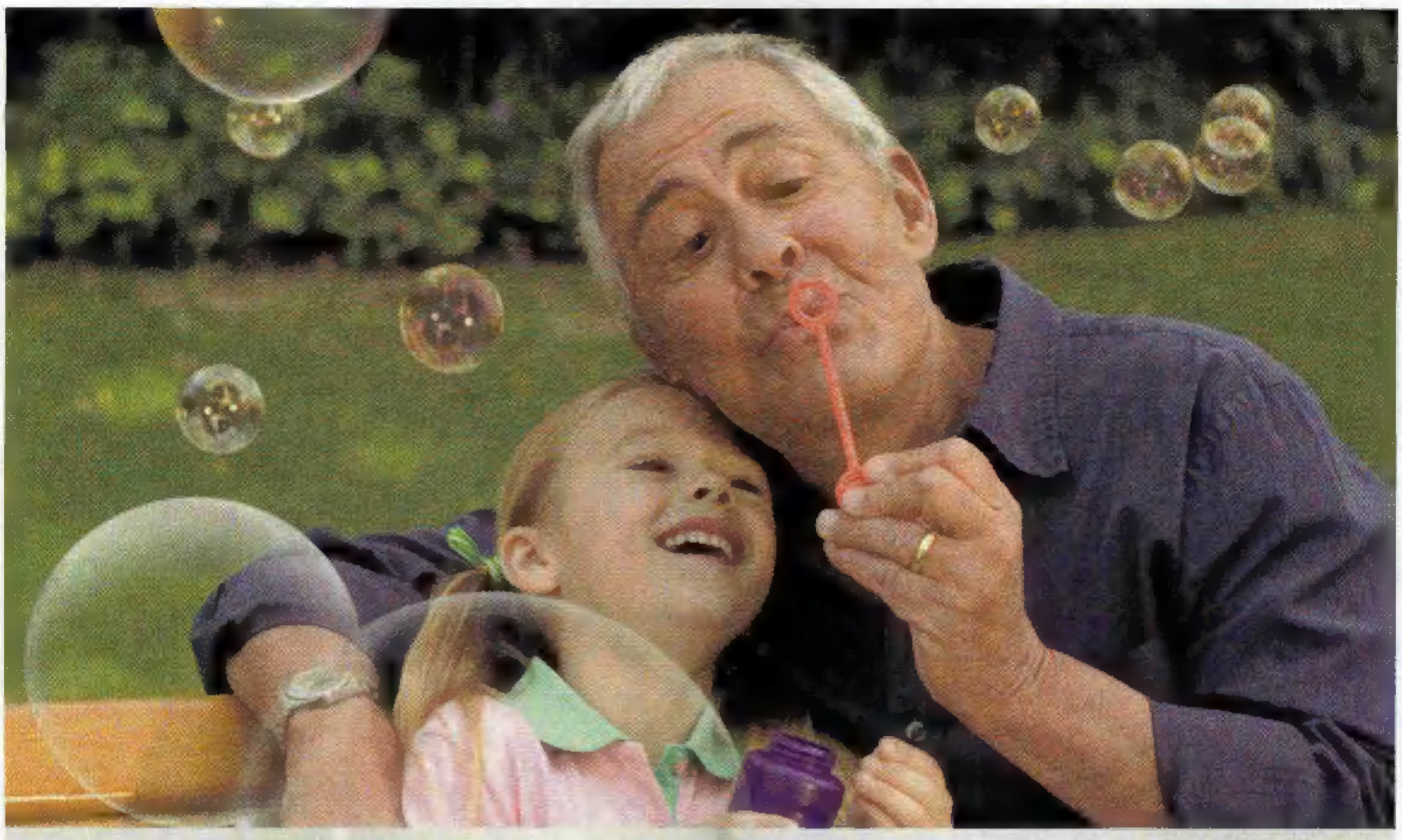

ADVAIR® significantly improves lung function to help you breathe better.*

If you have COPD associated with chronic bronchitis, ADVAIR 250/50 may help.

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Ask your doctor about ADVAIR today.

The way anti-inflammatories work in the treatment of COPD is not well defined.

Important Information: ADVAIR DISKUS 250/50 is approved for controlling symptoms and preventing wheezing in adults with COPD associated with chronic bronchitis. The benefit of using ADVAIR for longer than 6 months has not been evaluated. You should only take 1 inhalation of ADVAIR twice a day. Taking higher doses will not provide additional benefits but may increase your chance of certain side effects. Lower respiratory tract infections, including pneumonia, have been reported with ADVAIR. Patients at risk for developing bone loss (osteoporosis) and some eye problems (cataracts or glaucoma) should be aware that use of inhaled corticosteroids, including ADVAIR, may increase your risk. You should consider having regular eye exams. ADVAIR does not replace fast-acting inhalers for acute symptoms.

*Measured by a breathing test in people taking ADVAIR 250/50, compared with people taking either fluticasone propionate 250 mcg or salmeterol 50 mcg. Your results may vary.

GlaxoSmithKline

Partnership for Prescription Assistance

If you don't have prescription coverage, visit pparx.org, or call 1-888-4PPA-NOW (1-888-477-2669)

ADVAIR DISKUS 250/50
(fluticasone propionate 250 mcg and salmeterol 50 mcg inhalation powder)

If you smoke and want to quit, you can learn more at way2quit.com.

†Subject to eligibility. Restrictions apply. Please see accompanying important information about ADVAIR DISKUS 250/50.

Information about ADVAIR DISKUS

ADVAIR DISKUS 100/50, 250/50, 500/50

(fluticasone propionate 100, 250, 500 mcg and salmeterol 50 mcg inhalation powder)

What is the most important information I should know about ADVAIR DISKUS?
In patients with asthma, long-acting beta$_2$-agonist medicines such as salmeterol (one of the medications in ADVAIR®) may increase the chance of death from asthma problems. In a large asthma study, more patients who used salmeterol died from asthma problems compared with patients who did not use salmeterol. So ADVAIR is not for patients whose asthma is well controlled on another asthma controller medicine such as low- to medium-dose inhaled corticosteroids or only need a fast-acting inhaler once in a while. Talk with your doctor about this risk and the benefits of treating your asthma with ADVAIR.

ADVAIR should not be used to treat a severe attack of asthma or chronic obstructive pulmonary disease (COPD) requiring emergency medical treatment.

ADVAIR should not be used to relieve sudden symptoms or sudden breathing problems. Always have a fast-acting inhaler with you to treat sudden breathing difficulty. If you do not have a fast-acting inhaler, contact your doctor to have one prescribed for you.

What is ADVAIR DISKUS?
There are two medicines in ADVAIR: fluticasone propionate, an inhaled anti-inflammatory belonging to a group of medicines commonly referred to as corticosteroids; and salmeterol, a long-acting, inhaled bronchodilator belonging to a group of medicines commonly referred to as beta$_2$-agonists. There are 3 strengths of ADVAIR: 100/50, 250/50, 500/50.

For Asthma
- ADVAIR is approved for the maintenance treatment of asthma in patients 4 years of age and older. ADVAIR should only be used if your doctor decides that another asthma controller medicine alone does not control your asthma or that you need 2 asthma controller medications.
- The strength of ADVAIR approved for patients ages 4 to 11 years who experience symptoms on an inhaled corticosteroid is ADVAIR DISKUS 100/50. All 3 strengths are approved for patients with asthma ages 12 years and older.

For COPD associated with chronic bronchitis
ADVAIR 250/50 is the only approved dose for the maintenance treatment of airflow obstruction in patients with COPD associated with chronic bronchitis. The benefit of using ADVAIR for longer than 6 months has not been evaluated. The way anti-inflammatories work in the treatment of COPD is not well defined.

Who should not take ADVAIR DISKUS?
You should not start ADVAIR if your asthma is becoming significantly or rapidly worse, which can be life threatening. Serious respiratory events, including death, have been reported in patients who started taking salmeterol in this situation, although it is not possible to tell whether salmeterol contributed to these events. This may also occur in patients with less severe asthma.

You should not take ADVAIR if you have had an allergic reaction to it or any of its components (salmeterol, fluticasone propionate, or lactose). Tell your doctor if you are allergic to ADVAIR, any other medications, or food products. If you experience an allergic reaction after taking ADVAIR, stop using ADVAIR immediately and contact your doctor. Allergic reactions are when you experience one or more of the following: choking; breathing problems; swelling of the face, mouth and/or tongue; rash; hives; itching; or welts on the skin.

Tell your doctor about the following:
- If you are using your fast-acting inhaler more often or using more doses than you normally do (e.g., 4 or more inhalations of your fast-acting inhaler for 2 or more days in a row or a whole canister of your fast-acting inhaler in 8 weeks' time), it could be a sign that your asthma is getting worse. If this occurs, tell your doctor immediately.
- If you have been using your fast-acting inhaler regularly (e.g., four times a day). Your doctor may tell you to stop the regular use of these medications.
- If your peak flow meter results decrease. Your doctor will tell you the numbers that are right for you.
- If you have asthma and your symptoms do not improve after using ADVAIR regularly for 1 week.
- If you have been on an oral steroid, like prednisone, and are now using ADVAIR. You should be very careful as you may be less able to heal after surgery, infection, or serious injury. It takes a number of months for the body to recover its ability to make its own steroid hormones after use of oral steroids. Switching from an oral steroid may also unmask a condition previously suppressed by the oral steroid such as allergies, conjunctivitis, eczema, arthritis, and eosinophilic conditions. Symptoms of an eosinophilic condition can include rash, worsening breathing problems, heart complications, and/or feeling of "pins and needles" or numbness in the arms and legs. Talk to your doctor immediately if you experience any of these symptoms.
- Sometimes patients experience unexpected bronchospasm right after taking ADVAIR. This condition can be life threatening and if it occurs, you should immediately stop using ADVAIR and seek immediate medical attention.
- If you have any type of heart disease such as coronary artery disease, irregular heart beat or high blood pressure, ADVAIR should be used with caution. Be sure to talk with your doctor about your condition because salmeterol, one of the components of ADVAIR, may affect the heart by increasing heart rate and blood pressure. It may cause symptoms such as heart fluttering, chest pain, rapid heart rate, tremor, or nervousness.
- If you have seizures, overactive thyroid gland, liver problems, or are sensitive to certain medications for breathing.
- If your breathing problems get worse over time or if your fast-acting inhaler does not work as well for you while using ADVAIR. If your breathing problems worsen quickly, get emergency medical care.
- If you have been exposed to or currently have chickenpox or measles or if you have an immune system problem. Patients using medications that weaken the immune system are more likely to get infections than healthy individuals. ADVAIR contains a corticosteroid (fluticasone propionate) which may weaken the immune system. Infections like chickenpox and measles, for example, can be very serious or even fatal in susceptible patients using corticosteroids.

How should I take ADVAIR DISKUS?
ADVAIR should be used 1 inhalation, twice a day (morning and evening). ADVAIR should never be taken more than 1 inhalation twice a day. The full benefit of taking ADVAIR may take 1 week or longer.

If you miss a dose of ADVAIR, just skip that dose. Take your next dose at your usual time. Do not take two doses at one time.

Do not stop using ADVAIR unless told to do so by your doctor because your symptoms might get worse.

Do not change or stop any of your medicines used to control or treat your breathing problems. Your doctor will adjust your medicines as needed.

When using ADVAIR, remember:
- Never breathe into or take the DISKUS® apart.
- Always use the DISKUS in a level position.
- After each inhalation, rinse your mouth with water without swallowing.
- Never wash any part of the DISKUS. Always keep it in a dry place.
- Never take an extra dose, even if you feel you did not receive a dose.
- Discard 1 month after removal from the foil overwrap.
- Do not use ADVAIR with a spacer device.

Children should use ADVAIR with an adult's help as instructed by the child's doctor.

Can I take ADVAIR DISKUS with other medications?
Tell your doctor about all the medications you take, including prescription and nonprescription medications, vitamins, and herbal supplements.

If you are taking ADVAIR, you should not take SEREVENT® DISKUS or Foradil® Aerolizer® for any reason.

If you take ritonavir (an HIV medication), tell your doctor. Ritonavir may interact with ADVAIR and could cause serious side effects. The anti-HIV medicines Norvir® Soft Gelatin Capsules, Norvir Oral Solution, and Kaletra® contain ritonavir.

No formal drug interaction studies have been performed with ADVAIR.

In clinical studies, there were no differences in effects on the heart when ADVAIR was taken with varying amounts of albuterol. The effect of using ADVAIR in patients with asthma while taking more than 9 puffs a day of albuterol has not been studied.

ADVAIR should be used with extreme caution during and up to 2 weeks after treatment with monoamine oxidase (MAO) inhibitors or tricyclic antidepressants since these medications can cause ADVAIR to have an even greater effect on the circulatory system.

ADVAIR should be used with caution in people who are taking ketoconazole (an antifungus medication) or other drugs broken down by the body in a similar way. These medications can cause ADVAIR to have greater steroid side effects.

Generally, people with asthma should not take beta-blockers because they counteract the effects of beta$_2$-agonists and may also cause severe bronchospasm. However, in some cases, for instance, following a heart attack, selective beta-blockers may still be used if there is no acceptable alternative.

The ECG changes and/or low blood potassium that may occur with some diuretics may be made worse by ADVAIR, especially at higher-than-recommended doses. Caution should be used when these drugs are used together.

In clinical studies, there was no difference in side effects when ADVAIR was taken with methylxanthines (e.g., theophylline) or with FLONASE®.

What are other important safety considerations with ADVAIR DISKUS?
Osteoporosis: Long-term use of inhaled corticosteroids may result in bone loss (osteoporosis). Patients who are at risk for increased bone loss (tobacco use, advanced age, inactive lifestyle, poor nutrition, family history of osteoporosis, or long-term use of drugs such as corticosteroids) may have a greater risk with ADVAIR. If you have risk factors for bone loss, you should talk to your doctor about ways to reduce your risk and whether you should have your bone density evaluated.

Glaucoma and cataracts: Glaucoma, increased pressure in the eyes, and cataracts have been reported with the use of inhaled steroids, including fluticasone propionate, a medicine contained in ADVAIR. Regular eye examinations should be considered if you are taking ADVAIR.

Lower respiratory tract infection: Lower respiratory tract infections, including pneumonia, have been reported with the use of inhaled corticosteroids, including ADVAIR.

Blood sugar: Salmeterol may affect blood sugar and/or cause low blood potassium in some patients, which could lead to a side effect like an irregular heart rate. Significant changes in blood sugar and blood potassium were seen infrequently in clinical studies with ADVAIR.

Growth: Inhaled steroids may cause a reduction in growth velocity in children and adolescents.

Steroids: Taking steroids can affect your body's ability to make its own steroid hormones, which are needed during infections and times of severe stress to your body, such as an operation. These effects can sometimes be seen with inhaled steroids (but it is more common with oral steroids), especially when taken at higher-than-recommended doses over a long period of time. In some cases, these effects may be severe. Inhaled steroids often help control symptoms with less side effects than oral steroids.

Yeast infections: Patients taking ADVAIR may develop yeast infections of the mouth and/or throat ("thrush") that should be treated by their doctor.

Tuberculosis or other untreated infections: ADVAIR should be used with caution, if at all, in patients with tuberculosis, herpes infections of the eye, or other untreated infections.

What are the other possible side effects of ADVAIR DISKUS?
ADVAIR may produce side effects in some patients. In clinical studies, the most common side effects with ADVAIR included:

- Respiratory infections
- Throat irritation
- Hoarseness
- Sinus infection
- Yeast infection of the mouth
- Bronchitis
- Cough
- Headaches
- Nausea and vomiting
- Diarrhea
- Musculoskeletal pain
- Dizziness
- Fever
- Ear, nose, and throat infections
- Nosebleed

Tell your doctor about any side effect that bothers you or that does not go away. These are not all the side effects with ADVAIR. Ask your doctor or pharmacist for more information.

What if I am pregnant, planning to become pregnant, or nursing?
Talk to your doctor about the benefits and risks of using ADVAIR during pregnancy, labor, or if you are nursing. There have been no studies of ADVAIR used during pregnancy, labor, or in nursing women. Salmeterol is known to interfere with labor contractions. It is not known whether ADVAIR is excreted in breast milk, but other corticosteroids have been detected in human breast milk. Fluticasone propionate, like other corticosteroids, has been associated with birth defects in animals (e.g., cleft palate and fetal death). Salmeterol showed no effect on fertility in rats at 180 times the maximum recommended daily dose.

What other important tests were conducted with ADVAIR?
There is no evidence of enhanced toxicity with ADVAIR compared with the components administered separately. In animal studies with doses much higher than those used in humans, salmeterol was associated with uterine tumors. Your healthcare professional can tell you more about how drugs are tested on animals and what the results of these tests may mean to your safety.

For more information on ADVAIR DISKUS
This page is only a brief summary of important information about ADVAIR DISKUS. For more information, talk to your doctor. You can also visit www.ADVAIR.com or call 1-888-825-5249. Patients receiving ADVAIR DISKUS should read the medication guide provided by the pharmacist with the prescription.

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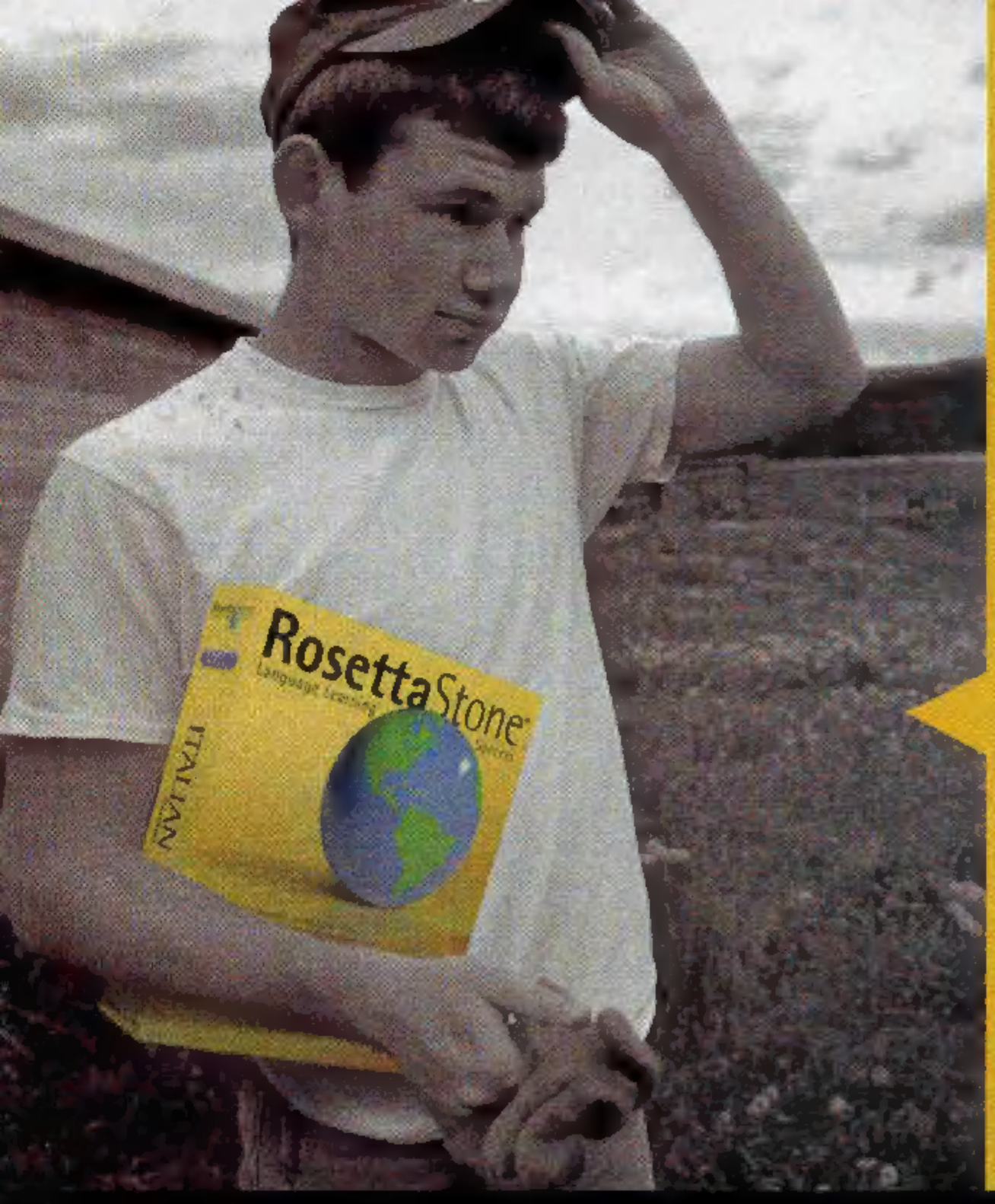

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EDITOR'S NOTE

On a beach in Gabon, conservationist Mike Fay was leading a group of people when one of the female elephants they were watching suddenly charged. To divert her, Fay stepped in front of the charging beast. She didn't stop.

"We fell to the ground, her tusks in my hands. Her eye was six inches from mine," he said. "For a moment we looked at one another. She started to roll over on me. My ribs cracked; my lungs collapsed. She stood up to regain her balance, or maybe because my death was not her objective. Then she ambled off. She'd stabbed me 13 times, but only punctured skin and muscle.

Armed guards patrol Chad's Zakouma National Park against poachers.

Though I was traumatized, I didn't blame the elephant. In fact, I feel closer to these animals than ever."

Fay still gets close to elephants. His most recent encounters took place in Zakouma National Park in southeastern Chad. In the 1970s, the Texas-size region of central Africa in which the park lies had an elephant population of perhaps 300,000. Today 10,000 remain. Around 3,500 of these animals find water in Zakouma during the dry season; when the rains come, they leave and trouble begins. From May through October of 2006, Fay found the bodies of a hundred elephants outside the park that had been killed for their ivory.

In 1989 in Kenya, I watched flames consume a pile of tusks at a celebration of a worldwide ban on ivory trade. I'm hopeful the slaughter is mostly over, that the world cherishes these giants. But conservation requires constant vigilance—even, as Mike Fay knows, at the risk of one's life.

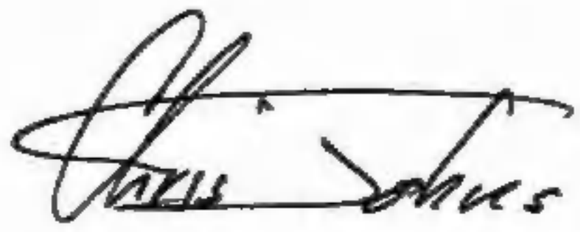

PHOTO: MICHAEL NICHOLS, NGS PHOTOGRAPHER

Guadalupe Junco
(Junco insularis)

Size: Length, approx. 6 inch; wingspan 7- 9 inch

Weight: 0.5 - 0.9 oz.

Habitat: Stands of cypress, pine and oak

Surviving number: Estimated at 1,000 individuals

Photographed by Ernesto C. Enkerlin Hoeflich

WILDLIFE AS CANON SEES IT

Paradise lost? The Guadalupe junco once had the run of its island home. Cypress forests provided all the seeds and insects the little bird needed and, quite unafraid, it made nests in low-hanging branches or depressions in the ground. The good life disappeared with the introduction of new species, which upset the natural balance. Insatiable goats were soon decimating the cypresses and housecats-gone-wild were on the prowl. As a result, junco populations plummeted to dangerously low levels. An aggressive effort to remove feral goats is helping bring back plant life on the island. But will the Guadalupe junco be able to follow?

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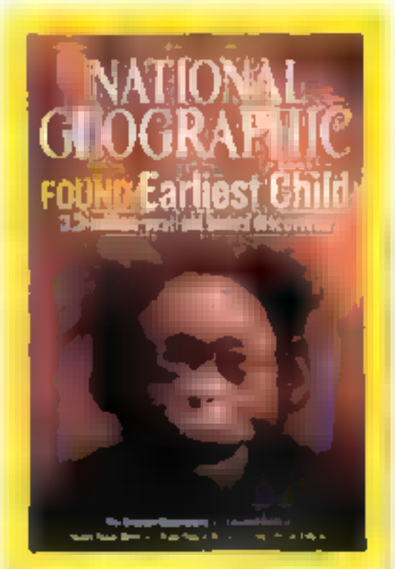

November 2006 *"From Fins to Wings" and "Origin of Childhood" prompted many readers to offer their opinions on evolution. The cover photo of the Dikika child also inspired letters of a less serious nature. Reader Dean Ashley writes, "My wife could hear the baby saying, 'Hey Mom, I cut my hair all by myself.'"*

Voice opinions about these stories at **ngm.com**.

From Fins to Wings

I am amazed at the faith demonstrated in this article. The faith that over the course of 600 million years an organism containing one cell could mutate and evolve into a human with ten trillion cells. The faith that this single-cell organism could have the potential and disposition to evolve into a human. And the faith that this single-cell organism appeared on the scene with no explanation for its origin. The faith indeed to move mountains.

DICK VAN ECK
Yorba Linda, California

I am sure you have been flooded with letters from creationists objecting to your story. I believe the complexity of interactions that make organisms work proves evolution beyond ■ shadow of ■ doubt. I can't envision an "intelligent designer" tinkering in his or her chemistry laboratory manufacturing each of the billions of flora and fauna on Earth.

FRANK DOMURATH
Linden, Michigan

Secularists ask, How has life on Earth changed over time? Answer: evolution. Fundamentalists ask, Where did life on Earth come from? Answer: God. Each camp ignores, minimizes, and dismisses the question they don't like. I, like so many Americans, belong to a third camp: Believers who have no problem with evolution as God's work. From where? God. How? Evolution. I'd recommend your article to secularists and fundamentalists.

To both I would say, read and marvel at the beauty of evolution and God.

JAKE McELLIGOTT
Pittsburgh, Pennsylvania

The article uses an analogy of a building being constructed. Viewed daily at 6 p.m., it looks to be building itself. Viewed continuously, one notices the tools used in its construction. Would these tools be as effective without an architect? Science is not above God nor does it replace God. Science is simply the discovery of how he does things.

MICHAEL MAGUIRE
Winter Springs, Florida

I cannot sign on to intelligent design. The traits that it considers the strongest evidence of a designer—complexity, interconnectedness, adaptations impossible to develop as a series of small steps—are shown to the most extreme degree in the life cycles of parasitic worms. What kind of a God are we talking about here? I'd rather leave it to evolution, thank you very much.

WYNN SCHAIBLE
Blue Bell, Pennsylvania

climber like a gorilla, but then an anthropologist, upon seeing her small canines and lack of ■ brow, concluded she was a hominin. Wouldn't it have made just as much sense to conclude that she was a chimpanzee, but one that had evolved smaller canines and a smoother brow?

MARGARET ERIKSSON
Fergus Falls, Minnesota

Origin of Childhood

I would think that you would have an easier time convincing people that your 3.3-million-year-old child is a hominin if she looked a little less like ■ chimpanzee. Your article notes that the child has the arms and shoulders of a tree

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LETTERS

After viewing the cover, I couldn't help but wonder what keeping primates in laboratories and using them for our entertainment says about human evolution.

ILSA MILLER
San Francisco, California

Greatest Mountaineer

One day in 1978, I reached Popocatépetl's 5,426-meter snowy crater after a strenuous, ten-hour climb. My lungs were desperately trying to extract oxygen from the scarce surrounding air. My legs aching, I saw the world that lay below. That moment, I felt like the king of creation. Just a few months later, news came about Reinhold Messner having conquered Everest with no supplementary oxygen. That meant he climbed 3,000 more meters than I did. I didn't feel defeated nor humiliated. Once you conquer a mountain, you become aware of the standing magnificence of the mountain, as well as the cruel indifference of nature. You also recognize in yourself the surprising size of human will. I enjoyed the article in a deep way, since in a mountain, each one of us finds the same feelings Messner describes.

FERNANDO OCÁDIZ MONTALBAN
Mexico City, Mexico

Caroline Alexander's article seamlessly depicts Messner's enormous mountaineering accomplishments and reveals the eccentric nature of his character. The piece left me struggling to merge a personal hero's drive and physical talent with his temperamental nature.

DANIEL BOVEE
Bishop, California

Reinhold Messner's list of summits is impressive from a technical mountaineering standpoint, but for those of us who find peace and beauty in nature without excessively endangering ourselves, our family, or friends, his condescension toward hiking is a little obnoxious. And which of his fabulous accomplishments really does anybody any good other than himself and the industry that surrounds him?

EVAN CANTOR
Boulder, Colorado

I was unaware of the existence of Reinhold Messner until I read Caroline Alexander's article. I cannot recall ever reading about anyone whose life reveals more self-indulgent uselessness. Shame on NGM for devoting valuable space to this arrogant buffoon whose life has been spent solely to please his personal whims.

BILL MAHAN
Alamosa, Colorado

Reinhold Messner is an extraordinary man. As he states, "There are moments in difficult situations, far away, that there is no more doubt. There, the questions are gone. . . . If the question is gone, I have not to answer. Myself living—I am the answer." To me, this quote is the purist expression of Zen I can imagine. Messner's "ego identification" with success and achievement is cancelled out by those ultimate moments of self-obliteration on the face of an icy rock wall, immersed in the now, thanks to his tremendous powers of concentration. Now, that's real meditation.

MICHAEL GAST
New York, New York


The okay picture that turns into an exceptional picture.
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LETTERS

Leopard Seals

First I opened to the photo essay and couldn't tear my eyes from Paul Nicklen's photographs. Then hoping to get more, I raced to view the riveting video of his assignment on your website. As a photographer, I am awestruck by these images and thankful for his enlightened observations of this magnificent predator.

GRETCHEN YENGST
Wilton, Connecticut

While I understand the difficulty in obtaining just the right shot for a magazine, especially one as spectacular as NATIONAL GEOGRAPHIC, I do feel that it is unnecessary to show a graphic photo of a leopard seal ripping the head off a penguin.

NEIL DANZIG
Columbia, Maryland

South Texas Waltz

Having been captivated by NATIONAL GEOGRAPHIC throughout my childhood, I am delighted to see my five-year-old daughter peruse the pages of the magazine in search of wildlife each month. My three-year-old daughter, however, has not found much to pique her interest—until now. When she saw the photo on pages 102-103, her eyes grew wide, and she exclaimed, "Mommy, look at all the princesses going to the ball!" Finally something she can relate to! Thank you for your dedication to exploring all walks of life.

AIMEE PELESS
Mt. Pleasant, Michigan

Your article purported to be about the interaction and love between the Anglo and Hispanic cultures. Instead it was a feature on several spoiled brats whose biggest ambition is to parade around in dresses that cost twice my annual salary. This does not include the lavish parties given for these girls. The money wasted on this outdated celebration would probably feed the poor in all of Texas for a year.

LEAH INNOCCI
Cheyenne, Wyoming

After viewing the cover, I couldn't help but wonder what keeping primates in laboratories and using them for our entertainment says about human evolution.

Voices

Superb interview with artists Christo and Jeanne-Claude. Their art evokes tears of joy from those who experience their beauty in person. I don't mean art critics. I mean the average rancher in Marin County ("Running Fence"), truck drivers on Interstate 5 through the Tejon Pass ("Umbrellas"), the little old lady walking her dog on a cold February day in Central Park ("Gates"). Even most scoffers are struck silent by the breathtaking gorgeousness of what Christo and Jeanne-Claude create.

JOHN AND STEPHANIE MOOD
San Diego, California

Special thanks to Cathy Newman and the editors for sharing the voices of Christo and Jeanne-Claude. Their "Gates" was an evocative art experience. One moment I was an observer, then I walked under a gate and was part of the art!

ALLAN LOHAUS
Clarksville, Maryland

Such so-called art generally gets a lot of attention because some of it is quite large, like the mess they want to make around the Arkansas River. However, that still doesn't make it art, and it doesn't make it acceptable for them to trash the naturally beautiful landscape.

GARY WITTENBORN
New Braunfels, Texas

Silliness masquerading as art is still silliness. Perhaps Christo described their "public art" the best: "They are made for us first. Not the public."

MARK WORSHAM
Savannah, Georgia

Inside Geographic

"Where's Nauru?" gave me an excellent idea, and I wanted to thank you. I consider myself an intelligent, professional woman. However, I am ashamed by how little I know about geography. Because of your article, I decided to celebrate Geography Awareness Week in my home and have each family member choose ■ country to discuss and show on a map. I thought my family would frown at the idea but instead everyone became excited. By the end of the week we each presented eight countries and learned about a total of 32!

SARA L. LLERENA
Miami, Florida

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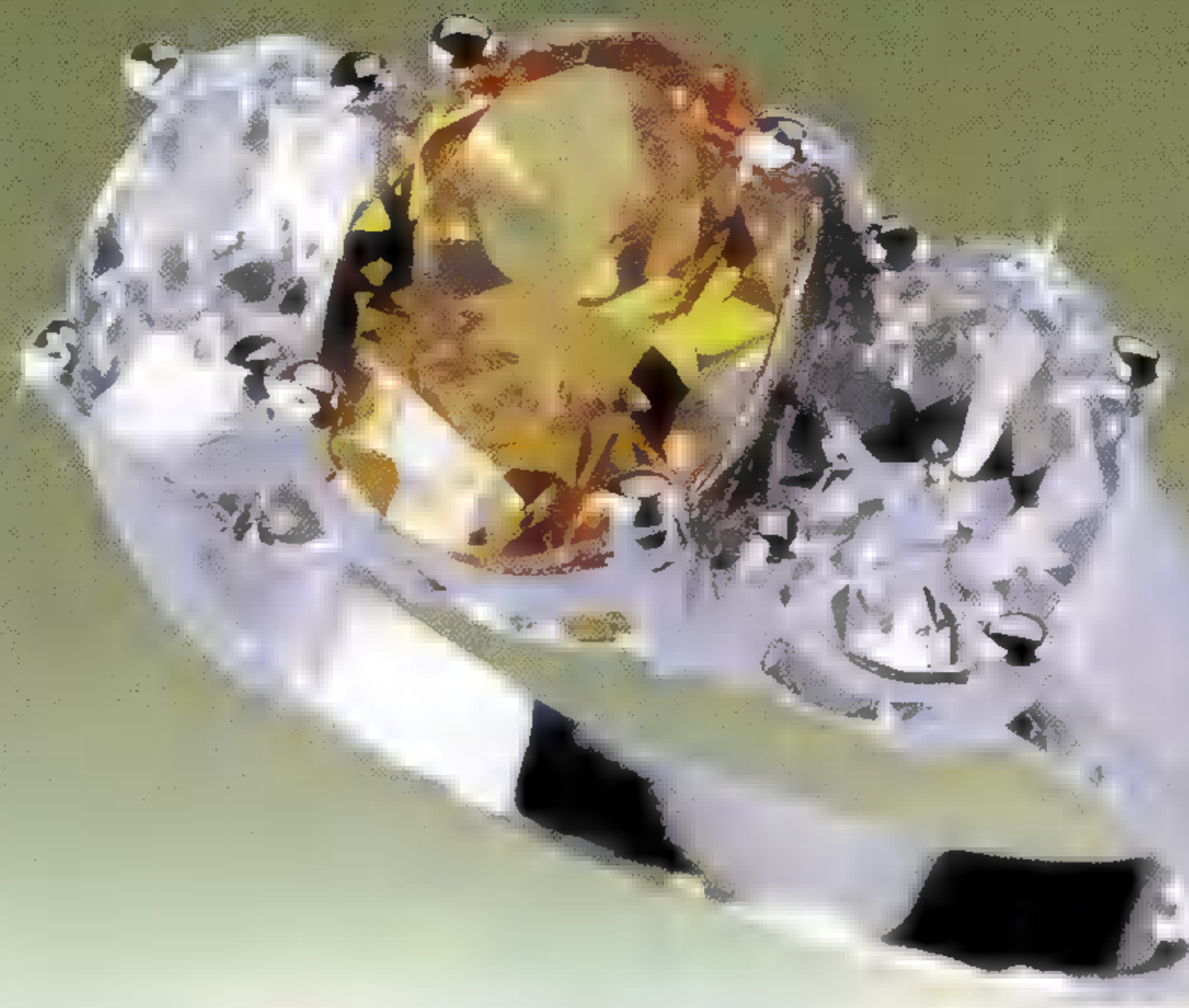

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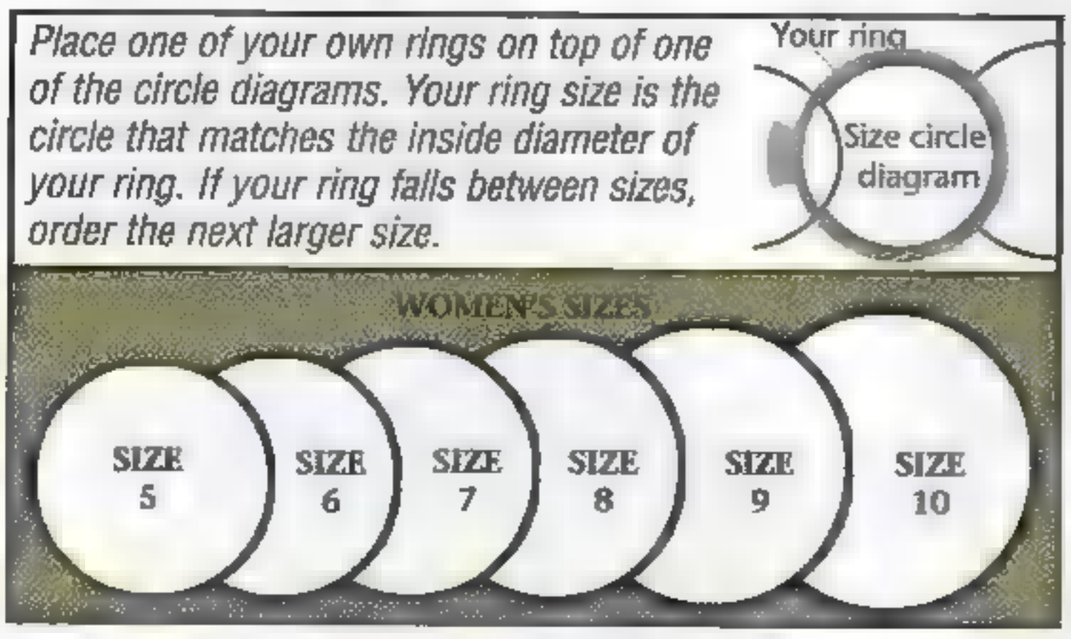
Our scientifically impeccable DiamondAura Canary Ring displays the many hues of a radiant sunrise for only a fraction of the cost.

My 5th generation Belgium gem broker is at the top of his trade and enjoys finding a special gem with a certain size, shape, color and clarity—he doesn't trade in what is available on the local market. During our visit, he proudly displayed a brilliant round-cut Canary diamond, explaining that natural yellow color diamonds are 10,000 times more rare than their brilliant white, colorless counterparts. Turning the stone in the light, he said the intensity of color is of paramount importance, and clarity increases the inherent value of a high-quality color diamond. He said this fine Canary Yellow gemstone, framed by two white diamonds, should retail for a minimum of $10,000. As my broker admired this treasure, I decided now was the time for a little amusement.

As he glanced away, I placed a similarly colored lab-created yellow Diamond*Aura* ring next to the natural mined diamond. My broker thought he was seeing double. After close examination he was astonished—the faultless, lab-created oval-cut Diamond*Aura* was so visually similar in almost every way! He started to wonder about the future of the diamond business.

We were inspired by it's radiant color. Influenced by the ultra-rare Canary diamond, we went to the gemological laboratory to craft this extraordinary jewelry using lab-created Diamond*Aura* that are practically indistinguishable to the naked eye from mined diamonds. Our Diamond*Auras* are heated to over 5000 degrees in very expensive state-of-the-art lab equipment to create Diamond*Aura*. The ring features an oval-cut canary Diamond*Aura* set in the center with two oval-cut white Diamond*Auras* on either side, for a total carat weight of over 5.5 carats. The center canary Diamond*Aura* will tantalize the eyes with its radiating color as the two white Diamond*Auras* that surround it glint and sparkle upon your hand. The band is .925 sterling silver that won't tarnish over time. Truly affordable elegance!



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Unexpected Strange and wonderful pictures filled the Your Shot mailbox this month: a mantis that looked like a samurai warrior, the translucent egg case of a cuttlefish, an otherworldly view of Alcatraz Island, and more. You too can send us something that surprises. For guidelines, a submission form, and more information, go to *ngm.com/yourshot.*

Irina Lynch London, England

She didn't know she'd photographed this airborne needlefish. On vacation in the Dominican Republic, Irina Lynch thought she was just taking a picture of the sea. "The sun was so blinding that I didn't even see the fish. I only heard a splash," she says. "I noticed the fish when I went back and looked at the photos."

Lynch, 27, works for a printing company in London. "I've been an amateur photographer since I was about 12 years old," she says. "I took pictures with my dad's Zenit camera and made a horrible mess developing them in the bathroom."

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Paul Nicklen peers up from the bow of an icebreaker cracking through the frozen crust of the Beaufort Sea.

A veteran of many cold-weather stories for NATIONAL GEOGRAPHIC, *photographer Paul Nicklen claims to "suffer terribly in the heat."*

A Life on Ice I moved to Nunavut in the Canadian Arctic when I was four years old, and my heart has never left. Mine was one of four non-native families living in the Baffin Island Inuit community of Kimmirut, population 220. My dad was the settlement's manager; my mom taught the local kids (including me). We didn't own a telephone, radio, or television. All our spare time was spent outside with the Inuit. They welcomed us into their lives and shared their skills for facing the challenges of a sometimes inhospitable place. The Inuit showed me how to appreciate their world. They taught me to feel confident in nature, and how to survive on the ice.

From the tiniest crystalline flake to the tallest towering bergs, photographing ice and snow now comes naturally to me: On one trip, I happily spent 40 days aboard the Canadian Coast Guard icebreaker *Louis S. St.-Laurent* (above), taking photographs and collecting zooplankton beneath thick ice in the Arctic Ocean's remote Canada Basin. As a child, I'd witness hunters standing for days at the sea edge, rifles poised, waiting for a seal kill. I'd see mothers with babies on their backs sitting for hours on the ice by a fishing hole, calling gently to the fish. I'm thankful that they taught me this patience. The success of my photography depends on my ability to wait.

Photo Gallery View more of Nicklen's Arctic images at **ngm.com/0401.**

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Caught in a blizzard while traveling from Ellesmere Island to Resolute Bay—60-mile-an-hour winds repeatedly tipped over my 600-pound komatik sled—I risked freezing my fingers in the minus 70°F windchill to take this picture (above). I've had a few peaceful moments, too: This fogbow (below) arched over Foxe Basin off Igloolik Island.

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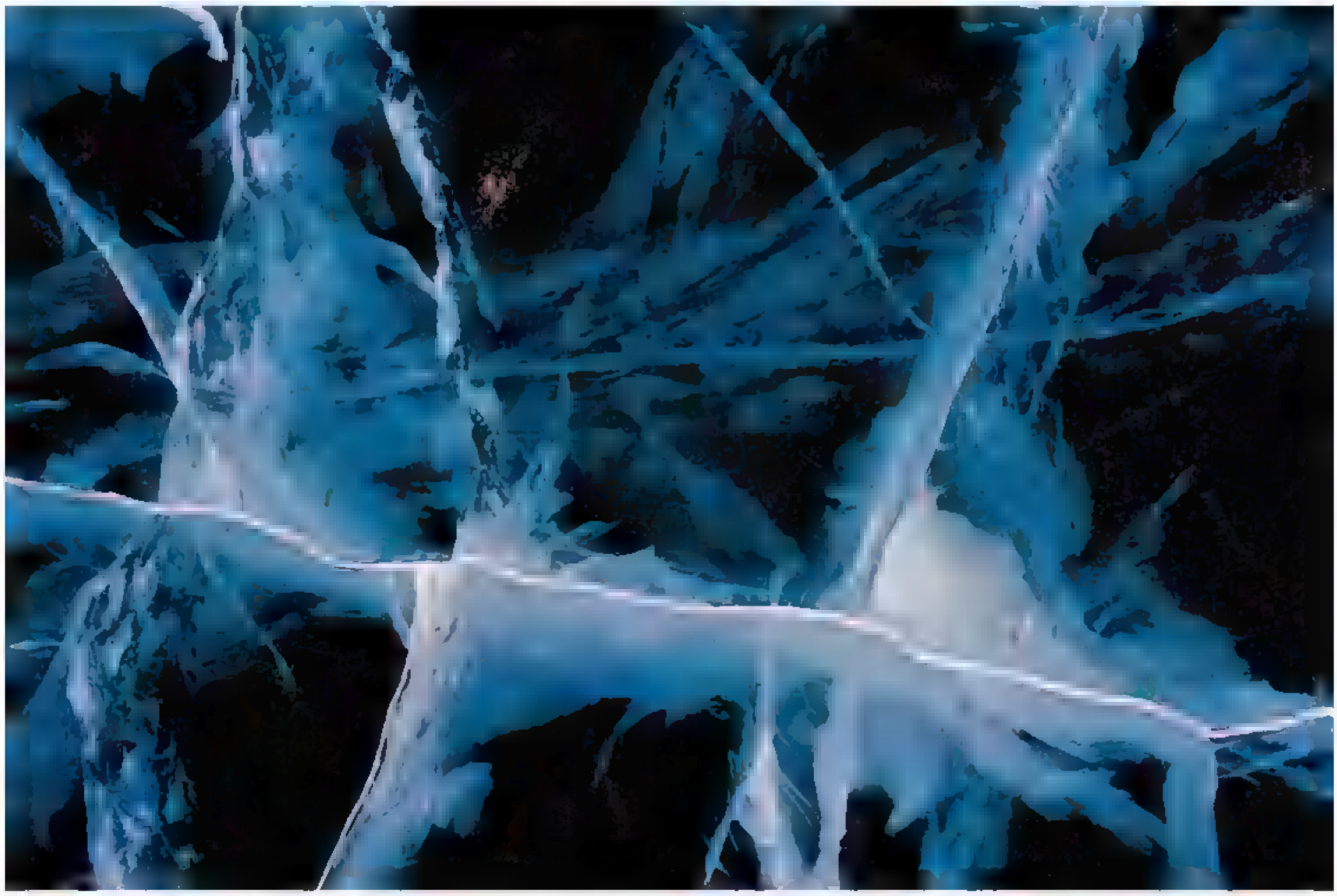
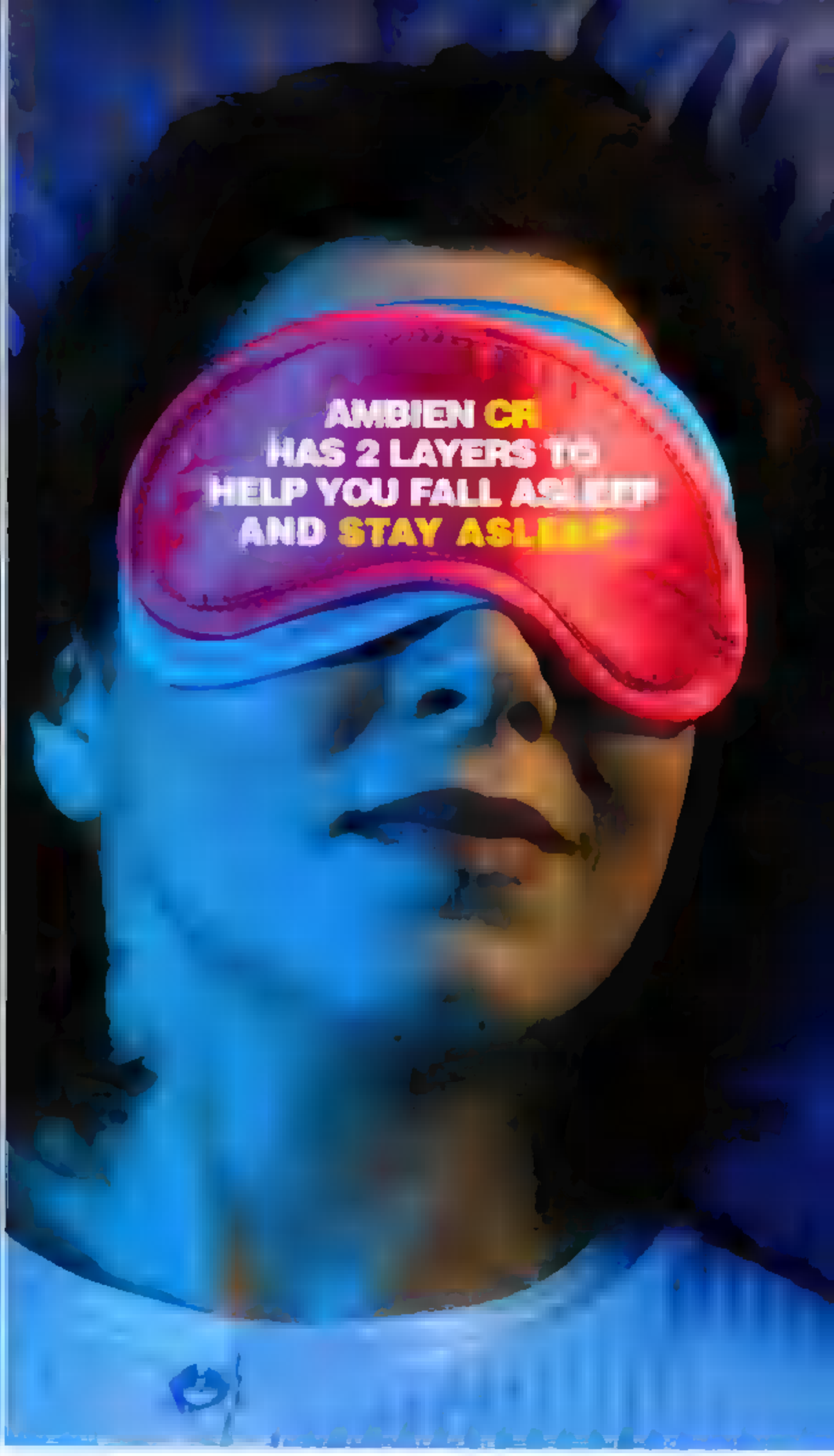
A STAR ALLIANCE MEMBER

I am obsessed with the shapes, formations, and colors of ice. While diving, I found these trapped bubbles glimmering in a piece of multiyear ice (above). Pressure cracks slash across lake ice on Ellesmere Island (below). Ice can get up to 12 feet thick in this area; this slab was at least eight feet thick—and probably more.





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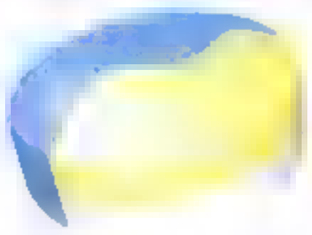

The first layer dissolves quickly to help you get to sleep fast.
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**Proven effective for up to 7 hours in clinical studies. **Individual results may vary.*

Important Safety Information

AMBIEN is indicated for the short-term treatment of insomnia.

When you first start taking AMBIEN, use caution in the morning when engaging in activities requiring complete alertness until you know how you will react to this medication. In most instances, memory problems can be avoided if you take AMBIEN only when you are able to get a full night's sleep (7 to 8 hours) before you need to be active again. As with any sleep medication, do not use alcohol while you are taking AMBIEN.

Prescription sleep aids are often taken for 7 to 10 days — or longer as advised by your healthcare provider. Like most sleep medicines, it has some risk of dependency.

There is a low occurrence of side effects associated with the short-term use of AMBIEN. The most commonly observed side effects in controlled clinical trials were drowsiness (2%), dizziness (1%), and diarrhea (1%).

AMBIEN CR is indicated for treating insomnia.

It is a treatment option you and your healthcare provider can consider along with lifestyle changes and can be taken for as long as your healthcare provider recommends. Until you know how AMBIEN CR will affect you, you shouldn't drive or operate machinery. Be sure you're able to devote 7 to 8 hours to sleep before being active again. Side effects may include next-day drowsiness, dizziness and headache. It's non-narcotic; however, like most sleep medicines, it has some risk of dependency. Don't take it with alcohol.

sanofi aventis

Not actual pill size. Please see important patient information on adjoining page. US.ACR.06.12.043 December 2006 Printed in USA

INFORMATION FOR PATIENTS
Ambien CR™ ℞
(zolpidem tartrate extended-release) tablets

AMBIEN CR™
ZOLPIDEM TARTRATE EXTENDED RELEASE ℞
6.25-MG & 12.5-MG EXTENDED RELEASE TABLETS

INFORMATION FOR PATIENTS TAKING AMBIEN CR

Your doctor has prescribed Ambien CR to help you sleep. The following information is intended to guide you in the safe use of this medicine. It is not meant to take the place of your doctor's instructions. If you have any questions about Ambien CR tablets be sure to ask your doctor or pharmacist.

Ambien CR is used to treat different types of sleep problems, such as:

- trouble falling asleep
- waking up often during the night

Some people may have more than one of these problems.

Ambien CR belongs to a group of medicines known as the "sedative/hypnotics", or simply, sleep medicines. There are many different sleep medicines available to help people sleep better. Sleep problems are usually temporary, requiring treatment for only a short time, usually 1 or 2 days up to 1 or 2 weeks. Some people have chronic sleep problems that may require more prolonged use of sleep medicine. However, you should not use these medicines for long periods without talking with your doctor about the risks and benefits of prolonged use.

SIDE EFFECTS

Most common side effects:

- headache
- somnolence (sleepiness)
- dizziness

You may find that these medicines make you sleepy during the day. How drowsy you feel depends upon how your body reacts to the medicine, which sleep medicine you are taking, and how large a dose your doctor has prescribed. Daytime drowsiness is best avoided by taking the lowest dose possible that will still help you sleep at night. Your doctor will work with you to find the dose of Ambien CR that is best for you.

To manage these side effects while you are taking this medicine:

- When you first start taking Ambien CR or any other sleep medicine until you know whether the medicine will still have some carryover effect in you the next day, use extreme care while doing anything that requires complete alertness, such as driving a car, operating machinery, or piloting an aircraft.
- NEVER drink alcohol while you are being treated with Ambien CR or any sleep medicine. Alcohol can increase the side effects of Ambien CR or any other sleep medicine.
- Do not take any other medicines without asking your doctor first. This includes medicines you can buy without a prescription. Some medicines can cause drowsiness and are best avoided while taking Ambien CR.
- Always take the exact dose of Ambien CR prescribed by your doctor. Never change your dose without talking to your doctor first.

SPECIAL CONCERNS

There are some special problems that may occur while taking sleep medicines.

Memory problems: Sleep medicines may cause a special type of memory loss or "amnesia." When this occurs, a person may not remember what has happened for several hours after taking the medicine. This is usually not a problem since most people fall asleep after taking the medicine.

Memory loss can be a problem, however, when sleep medicines are taken while traveling, such as during an airplane flight and the person wakes up before the effect of the medicine is gone. This has been called "traveler's amnesia."

Be sure to talk to your doctor if you think you are having memory problems. Although memory problems are not very common while taking Ambien CR, in most instances, they can be avoided if you take Ambien CR only when you are able to get a full night's sleep (7 to 8 hours) before you need to be active again.

Tolerance: When sleep medicines are used every night for more than a few weeks, they may lose their effectiveness to help you sleep. This is known as "tolerance". Sleep medicines should, in most cases, be used only for short periods of time, such as 1 or 2 days and generally no longer than 1 or 2 weeks. If your sleep problems continue, consult your doctor, who will determine whether other measures are needed to overcome your sleep problems.

Dependence: Sleep medicines can cause dependence, especially when these medicines are used regularly for longer than a few weeks or at high doses. Some people develop a need to continue taking their medicines. This is known as dependence or "addiction."

When people develop dependence, they may have difficulty stopping the sleep medicine. If the medicine is suddenly stopped, the body is not able to function normally and unpleasant symptoms may occur (see *Withdrawal*). They may find that they have to keep taking the medicines either at the prescribed dose or at increasing doses just to avoid withdrawal symptoms.

All people taking sleep medicines have some risk of becoming dependent on the medicine. However, people who have been dependent on alcohol or other drugs in the past may have a higher chance of becoming addicted to sleep medicines. This possibility must be considered before using these medicines for more than a few weeks.

If you have been addicted to alcohol or drugs in the past, it is important to tell your doctor before starting Ambien or any sleep medicine.

Withdrawal: Withdrawal symptoms may occur when sleep medicines are stopped suddenly after being used daily for a long time. In some cases, these symptoms can occur even if the medicine has been used for only a week or two.

In mild cases, withdrawal symptoms may include unpleasant feelings. In more severe cases, abdominal and muscle cramps, vomiting, sweating, shakiness, and rarely, seizures may occur. These more severe withdrawal symptoms are very uncommon.

Another problem that may occur when sleep medicines are stopped is known as "rebound insomnia." This means that a person may have more trouble sleeping the first few nights after the medicine is stopped than before starting the medicine. If you should experience rebound insomnia, do not get discouraged. This problem usually goes away on its own after 1 or 2 nights.

If you have been taking Ambien CR or any other sleep medicine for more than 1 or 2 weeks, do not stop taking it on your own. Always follow your doctor's directions.

Changes in behavior and thinking: Some people using sleep medicines have experienced unusual changes in their thinking and/or behavior. These effects are not common. However, they have included:

- more outgoing or aggressive behavior than normal
- confusion
- strange behavior
- agitation
- hallucinations
- worsening of depression
- suicidal thoughts

How often these effects occur depends on several factors, such as a person's general health, the use of other medicines, and which sleep medicine is being used.

It is also important to realize that it is rarely clear whether these behavior changes are caused by the medicine, an illness, or occur on their own. In fact, sleep problems that do not improve may be due to illnesses that were present before the medicine was used. If you or your family notice any changes in your behavior, or if you have any unusual or disturbing thoughts, call your doctor immediately.

Pregnancy: Sleep medicines may cause sedation of the unborn baby when used during the last weeks of pregnancy.

Be sure to tell your doctor if you are pregnant, if you are planning to become pregnant, or if you become pregnant while taking Ambien CR.

SAFE USE OF SLEEPING MEDICINES

To ensure the safe and effective use of Ambien CR or any other sleep medicine, you should observe the following cautions:

1. Ambien CR is a prescription medicine and should be used ONLY as directed by your doctor. Follow your doctor's instructions about how to take, when to take, and how long to take Ambien CR. Ambien CR tablets should not be divided, crushed, or chewed, and must be swallowed whole.
2. Never use Ambien CR or any other sleep medicine for longer than directed by your doctor.
3. If you notice any unusual and/or disturbing thoughts or behavior during treatment with Ambien CR or any other sleep medicine, contact your doctor.
4. Tell your doctor about any medicines you may be taking, including medicines you may buy without a prescription. You should also tell your doctor if you drink alcohol. DO NOT use alcohol while taking Ambien CR or any other sleep medicine.
5. Do not take Ambien CR unless you are able to get a full night's sleep before you must be active again. For example, Ambien CR should not be taken on an overnight airplane flight of less than 7 to 8 hours since "traveler's amnesia" may occur.
6. Do not increase the prescribed dose of Ambien CR or any other sleep medicine unless instructed by your doctor.
7. When you first start taking Ambien CR or any other sleep medicine, until you know whether the medicine will still have some carryover effect in you the next day, use extreme care while doing anything that requires complete alertness, such as driving a car, operating machinery, or piloting an aircraft.
8. Be aware that you may have more sleeping problems the first night after stopping Ambien CR or any other sleep medicine.
9. Be sure to tell your doctor if you are pregnant, if you are planning to become pregnant, or if you become pregnant while taking Ambien CR or any other sleep medicine.
10. As with all prescription medicines, never share Ambien CR or any other sleep medicine with anyone else. Always store Ambien CR or any other sleep medicine in the original container that you received it in and store it out of reach of children.
11. Ambien CR works very quickly. You should only take Ambien CR right before going to bed and are ready to go to sleep.

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Printed in USA AMBCR-FEB06-IFP-Ad Revised February 2006 Country of Origin: France

INFORMATION FOR PATIENTS
Ambien® C-IV
(zolpidem tartrate)

AMBIEN® (ZOLPIDEM TARTRATE) C-IV

INFORMATION FOR PATIENTS TAKING AMBIEN

Your doctor has prescribed Ambien to help you sleep. The following information is intended to guide you in the safe use of this medicine. It is not meant to take the place of your doctor's instructions. If you have any questions about Ambien tablets be sure to ask your doctor or pharmacist.

Ambien is used to treat different types of sleep problems, such as:

- trouble falling asleep
- waking up too early in the morning
- waking up often during the night

Some people may have more than one of these problems.

Ambien belongs to a group of medicines known as the "sedative/hypnotics," or simply, sleep medicines. There are many different sleep medicines available to help people sleep better. Sleep problems are usually temporary, requiring treatment for only a short time, usually 1 or 2 days up to 1 or 2 weeks. Some people have chronic sleep problems that may require more prolonged use of sleep medicine. However, you should not use these medicines for long periods without talking with your doctor about the risks and benefits of prolonged use.

SIDE EFFECTS

Most common side effects: All medicines have side effects. Most common side effects of sleep medicines include

- drowsiness
- dizziness
- lightheadedness
- difficulty with coordination

You may find that these medicines make you sleepy during the day. How drowsy you feel depends upon how your body reacts to the medicine, which sleep medicine you are taking, and how large a dose your doctor has prescribed. Daytime drowsiness is best avoided by taking the lowest dose possible that will still help you sleep at night. Your doctor will work with you to find the dose of Ambien that is best for you.

To manage these side effects while you are taking this medicine:

- When you first start taking Ambien or any other sleep medicine until you know whether the medicine will still have some carryover effect in you the next day, use extreme care while doing anything that requires complete alertness, such as driving a car, operating machinery, or piloting an aircraft.
- NEVER drink alcohol while you are being treated with Ambien or any sleep medicine. Alcohol can increase the side effects of Ambien or any other sleep medicine.
- Do not take any other medicines without asking your doctor first. This includes medicines you can buy without a prescription. Some medicines can cause drowsiness and are best avoided while taking Ambien.
- Always take the exact dose of Ambien prescribed by your doctor. Never change your dose without talking to your doctor first.

SPECIAL CONCERNS

There are some special problems that may occur while taking sleep medicines.

Memory problems: Sleep medicines may cause a special type of memory loss or "amnesia." When this occurs, a person may not remember what has happened for several hours after taking the medicine. This is usually not a problem since most people fall asleep after taking the medicine.

Memory loss can be a problem, however, when sleep medicines are taken while traveling, such as during an airplane flight and the person wakes up before the effect of the medicine is gone. This has been called "traveler's amnesia."

Memory problems are not common while taking Ambien. In most instances memory problems can be avoided if you take Ambien only when you are able to get a full night's sleep (7 to 8 hours) before you need to be active again. Be sure to talk to your doctor if you think you are having memory problems.

Tolerance: When sleep medicines are used every night for more than a few weeks, they may lose their effectiveness to help you sleep. This is known as "tolerance." Sleep medicines should, in most cases, be used only for short periods of time, such as 1 or 2 days and generally no longer than 1 or 2 weeks. If your sleep problems continue, consult your doctor, who will determine whether other measures are needed to overcome your sleep problems.

Dependence: Sleep medicines can cause dependence, especially when these medicines are used regularly for longer than a few weeks or at high doses. Some people develop a need to continue taking their medicines. This is known as dependence or "addiction."

When people develop dependence, they may have difficulty stopping the sleep medicine. If the medicine is suddenly stopped, the body is not able to function normally and unpleasant symptoms (see *Withdrawal*) may occur. They may find they have to keep taking the medicine either at the prescribed dose or at increasing doses just to avoid withdrawal symptoms.

All people taking sleep medicines have some risk of becoming dependent on the medicine. However, people who have been dependent on alcohol or other drugs in the past may have a higher chance of becoming addicted to sleep medicines. This possibility must be considered before using these medicines for more than a few weeks.

If you have been addicted to alcohol or drugs in the past, it is important to tell your doctor before starting Ambien or any sleep medicine.

Withdrawal: Withdrawal symptoms may occur when sleep medicines are stopped suddenly after being used daily for a long time. In some cases, these symptoms can occur even if the medicine has been used for only a week or two.

In mild cases, withdrawal symptoms may include unpleasant feelings. In more severe cases, abdominal and muscle cramps, vomiting, sweating, shakiness, and rarely, seizures may occur. These more severe withdrawal symptoms are very uncommon.

Another problem that may occur when sleep medicines are stopped is known as "rebound insomnia." This means that a person may have more trouble sleeping the first few nights after the medicine is stopped than before starting the medicine. If you should experience rebound insomnia, do not get discouraged. This problem usually goes away on its own after 1 or 2 nights.

If you have been taking Ambien or any other sleep medicine for more than 1 or 2 weeks, do not stop taking it on your own. Always follow your doctor's directions.

Changes in behavior and thinking: Some people using sleep medicines have experienced unusual changes in their thinking and/or behavior. These effects are not common. However, they have included:

- more outgoing or aggressive behavior than normal
- loss of personal identity
- confusion
- strange behavior
- agitation
- hallucinations
- worsening of depression
- suicidal thoughts

How often these effects occur depends on several factors, such as a person's general health, the use of other medicines, and which sleep medicine is being used. Clinical experience with Ambien suggests that it is uncommonly associated with these behavior changes

It is also important to realize that it is rarely clear whether these behavior changes are caused by the medicine, an illness, or occur on their own. In fact, sleep problems that do not improve may be due to illnesses that were present before the medicine was used. If you or your family notice any changes in your behavior, or if you have any unusual or disturbing thoughts, call your doctor immediately.

Pregnancy: Sleep medicines may cause sedation of the unborn baby when used during the last weeks of pregnancy.

Be sure to tell your doctor if you are pregnant, if you are planning to become pregnant, or if you become pregnant while taking Ambien.

SAFE USE OF SLEEPING MEDICINES

To ensure the safe and effective use of Ambien or any other sleep medicine, you should observe the following cautions:

1. Ambien is a prescription medicine and should be used ONLY as directed by your doctor. Follow your doctor's instructions about how to take, when to take, and how long to take Ambien.
2. Never use Ambien or any other sleep medicine for longer than directed by your doctor.
3. If you notice any unusual and/or disturbing thoughts or behavior during treatment with Ambien or any other sleep medicine, contact your doctor.
4. Tell your doctor about any medicines you may be taking, including medicines you may buy without a prescription. You should also tell your doctor if you drink alcohol. DO NOT use alcohol while taking Ambien or any other sleep medicine.
5. Do not take Ambien unless you are able to get a full night's sleep before you must be active again. For example, Ambien should not be taken on an overnight airplane flight of less than 7 to 8 hours since "traveler's amnesia" may occur.
6. Do not increase the prescribed dose of Ambien or any other sleep medicine unless instructed by your doctor.
7. When you first start taking Ambien or any other sleep medicine until you know whether the medicine will still have some carryover effect in you the next day, use extreme care while doing anything that requires complete alertness, such as driving a car, operating machinery, or piloting an aircraft.
8. Be aware that you may have more sleeping problems the first night or two after stopping Ambien or any other sleep medicine.
9. Be sure to tell your doctor if you are pregnant, if you are planning to become pregnant, or if you become pregnant while taking Ambien.
10. As with all prescription medicines, never share Ambien or any other sleep medicine with anyone else. Always store Ambien or any other sleep medicine in the original container out of reach of children.
11. Ambien works very quickly. You should only take Ambien right before going to bed and are ready to go to sleep.

Ambien® C-IV
(zolpidem tartrate)

Printed in USA

PRESIDENT'S NOTE

Greeting the crowd at the ceremony were conservationist Mike Fay, from left, archaeologist Constanza Ceruti, biologist Enric Sala, photographer Reza, and NGS President John Fahey.

The telephone rang in my office one day last May with wonderful news. A gentleman was calling from Spain to tell me that the National Geographic Society had been named the winner of a Prince of Asturias award. For 25 years, these prestigious honors have been presented in the name of the crown prince of Spain "to acknowledge scientific, cultural, and social work carried out at an international level . . . by individuals, teams, or institutions whose achievements are exemplary for Mankind." The Society had been selected as the 2006 honoree for Communications and Humanities. Other winners have included the Bill and Melinda Gates Foundation and filmmaker Pedro Almodóvar; more information can be found at *fpa.es/ing*. My colleagues and I were thrilled and gratified by the recognition, as well as by the enthusiastic congratulations that poured in from around the world.

As I walked down the aisle of the grand hall in Oviedo, Spain, in October to accept this honor from His Royal Highness Felipe de Borbón y Grecia on the Society's behalf, I thought about the thousands of men and women who have worked so passionately through the years to explore and illuminate our world. I also thought about our founders, those 33 visionaries who joined to form an organization 119 years ago "for the increase and diffusion of geographic knowledge." Today we see our purpose as nothing less than inspiring people to care about the planet—and we accept the award from our friends in Spain by rededicating ourselves to that task.

PHOTO: ELOY ALONSO, FPA

Our natural resources are worth protecting. *That's why Waste Management works with communities and the Wildlife Habitat Council to use the property adjacent to our landfills as safe havens for native animal and plant life. You might say it's in our nature to do what's good for the environment.*

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VISIONS OF EARTH

Château-d'Oex, Switzerland As the International Hot Air Balloon Festival nears liftoff, balloonists inspect an "envelope"—the fabric of their craft. Each $20,000 envelope lasts for just 400 to 500 hours of flying time.

PHOTO: ANDREE-NOELLE POT, EPA/CORBIS

Ontario, Canada Like fried eggs sizzling on a skillet, swirls of pulp mill waste bubble across treatment ponds near Terrace Bay. The average pulp mill requires more than 16 million gallons of fresh water daily.

PHOTO: J. HENRY FAIR

Wuhan, China Sleeping mats dot the floor of a university building in Hubei Province—kindergarten-style accommodation for hundreds of parents eager to make sure the college year starts out right for their children.

Decorate Your Desktop with Visions of Earth images at **ngm.com/0703.**

PHOTO: CORBIS/REUTERS

UNDER SOUTHERN AFRICAN SKIES . . .

Zambia – Victoria Falls and the Zambezi River As the micro-light taxis into position, the sense of anticipation is electric. Victoria Falls, named by the Kololo people 'Mosi-Oa-Tunya' meaning 'the smoke that thunders', lies just a short flight away. Lifting into the bright morning sky, the wide, open views of majestic Africa below are overwhelming. As the falls first come into sight, it is truly a breathtaking moment. Huge rivers of water cascade downward into the zig-zag of the ancient valley and shimmering rainbows crisscross the void. There is no better way to start the day . . . but to end the day?

Once again Africa continues to surprise, revealing effortless luxury and a uniquely romantic experience. Lit by flickering lanterns and glittering starlight above, our san pan floats gently on the placid river currents, the most atmospheric dinner venue in the world. Stunning food and outstanding wine are ferried across by silent canoe, quickly disappearing, leaving us to soak up the sublime solitude of the setting. That night in Africa, watching the world drift by, was a truly unforgettable experience.

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STAR ALLIANCE™
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Not a Dino With its two-legged walking act, *Effigia okeeffeae* (right) resembled dinosaurs that would live 80 million years later. In fact, the late Triassic reptile was no dinosaur but a relative of the forebears of modern crocodiles. *Effigia* was dug up, but not noticed, in the 1940s in New Mexico's badlands, a haunt of painter Georgia O'Keeffe, for whom the species is named. How is it that this beaked croc relative, which measured at least eight feet long, so resembled birdlike dinosaurs? Sterling Nesbitt, a paleontologist at the American Museum of Natural History who discovered the fossil in museum storage, says it's an example of evolutionary convergence: Reptiles of different lineages paradoxically resembled each other because they evolved in similar environments. *—Chris Carroll*

ART: RAÚL MARTÍN

There's relief for pain like this.

Do you feel burning pain in your feet? Or uncomfortable tingling, numbness, stabbing or shooting sensations?

If so, you may have nerve pain. This type of pain is different from other kinds of pain. Common pain medicines like aspirin may not work very well for this kind of pain. Ask your doctor if LYRICA® can help. Prescription LYRICA is one of several pain relief treatments for you and your doctor to consider. LYRICA was specially designed to relieve two common types of nerve pain, Diabetic Nerve Pain and Pain after Shingles. LYRICA works on the nerves that cause pain to provide the relief you need. Which is a step in the right direction.

LYRICA ■ not for everyone. Some of the most common side effects of LYRICA are dizziness and sleepiness. Others are dry mouth, swelling of hands and feet, blurry vision, weight gain, and trouble concentrating. You may have a higher chance of swelling or gaining weight if you are also taking certain diabetes medicines. And, if you drink alcohol or take medicines that make you sleepy, you may feel more sleepy when you start LYRICA. You should not drive a car or work with machines until you know how LYRICA affects you. Tell your doctor about any changes in your eyesight, muscle pain along with a fever or tired feeling, or skin sores due to diabetes. Also tell your doctor if you are planning to father a child. If you have had a drug or alcohol problem, you may be more likely to misuse LYRICA. You should talk with your doctor before you stop taking LYRICA or any other prescription medication.

Please see important product information on adjacent page.

LYRICA®
PREGABALIN Ⓒ
capsules

Talk to your doctor about LYRICA.
To learn more visit www.lyrica.com or call toll-free 1-888-9-LYRICA (1-888-959-7422).

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helpful answers

IMPORTANT FACTS

LYRICA® PREGABALIN capsules (LEER-i-kah)

IMPORTANT SAFETY INFORMATION ABOUT LYRICA

LYRICA may make you feel dizzy or sleepy.

- Do not drive a car, work with machines, or do other dangerous things until you are sure you will be alert. Ask your doctor when it is okay to do these things.

LYRICA may cause problems with your eyesight, including blurry vision. Call your doctor if you have any changes in your eyesight.

ABOUT LYRICA

LYRICA is a prescription medicine used to treat:

- Nerve pain from diabetes
- Nerve pain that continues after the rash from shingles heals

This pain can be sharp or burning. It can feel like tingling, shooting, or numbness. Some people taking LYRICA had less pain by the end of the first week. LYRICA may not work for everyone.

WHO IS LYRICA FOR?

Who can take LYRICA:

- Adults 18 years or older with nerve pain from diabetes or after shingles

Who should NOT take LYRICA:

- Anyone who is allergic to anything in LYRICA

LYRICA has not been studied for nerve pain in children under 18 years of age.

BEFORE STARTING LYRICA

Tell your doctor about all your medical conditions.
Tell your doctor if you:

- Have or had kidney problems or dialysis
- Have heart problems, including heart failure
- Have a bleeding problem or a low blood platelet count
- Have abused drugs or alcohol. LYRICA may cause some people to feel "high."
- Are either a man or woman planning to have children or a woman who is breast-feeding, pregnant, or may become pregnant. It is not known if LYRICA may decrease male fertility, cause birth defects, or pass into breast milk.

Tell your doctor about all your medicines. Include over-the-counter medicines, vitamins, and herbal products. Tell your doctor if you take:

- Rosiglitazone (Avandia®)* or pioglitazone (Actos®)** for diabetes
- Narcotic pain medicines such as oxycodone, tranquilizers, or medicines for anxiety such as lorazepam
- Any medicines that make you sleepy

PB274824C

POSSIBLE SIDE EFFECTS OF LYRICA

LYRICA may cause serious side effects, including:

- Dizziness and sleepiness
- Eyesight problems
- Weight gain and swelling of hands and feet. Weight gain may affect control of diabetes. Weight gain and swelling can be serious for people with heart problems.
- Unexplained muscle pain, soreness, or weakness along with a fever or tired feeling. If you have these symptoms, tell your doctor right away.
- Skin sores. In LYRICA studies, skin sores were seen in animals but not in humans. If you have diabetes, pay extra attention to your skin. Tell your doctor about any skin problems.

The most common side effects of LYRICA are:

- Dizziness
- Sleepiness
- Swelling of hands and feet
- Blurry vision
- Weight gain
- Trouble concentrating
- Dry mouth

You may have a higher chance of swelling or gaining weight if you are taking certain diabetes medicines with LYRICA. Medicines that already make you sleepy or dizzy may make you feel more sleepy or dizzy with LYRICA.

HOW TO TAKE LYRICA

Do:

- Take LYRICA exactly as your doctor tells you. Your doctor may tell you to take it 2 or 3 times a day.
- Take LYRICA with or without food.

Don't:

- Do not drive a car or use machines if you feel sleepy while taking LYRICA.
- Do not drink alcohol or use other medicines that make you sleepy while taking LYRICA.
- Do not change the dose or stop LYRICA suddenly. You may have headaches, nausea, diarrhea, or trouble sleeping if you stop taking LYRICA suddenly.
- Do not start any new medicines without first talking to your doctor.

NEED MORE INFORMATION?

- Ask your doctor or pharmacist. This is only a brief summary of important information.
- Go to **www.lyrica.com** or call **1-888-9-LYRICA (1-888-959-7422).**

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PBIF Rev. 1, May 2006

Rx only

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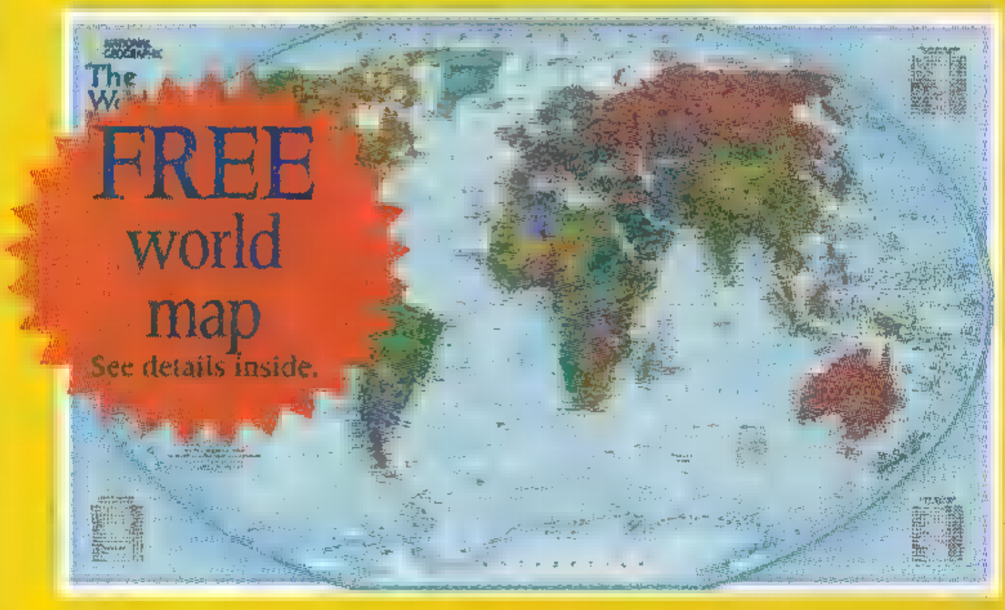
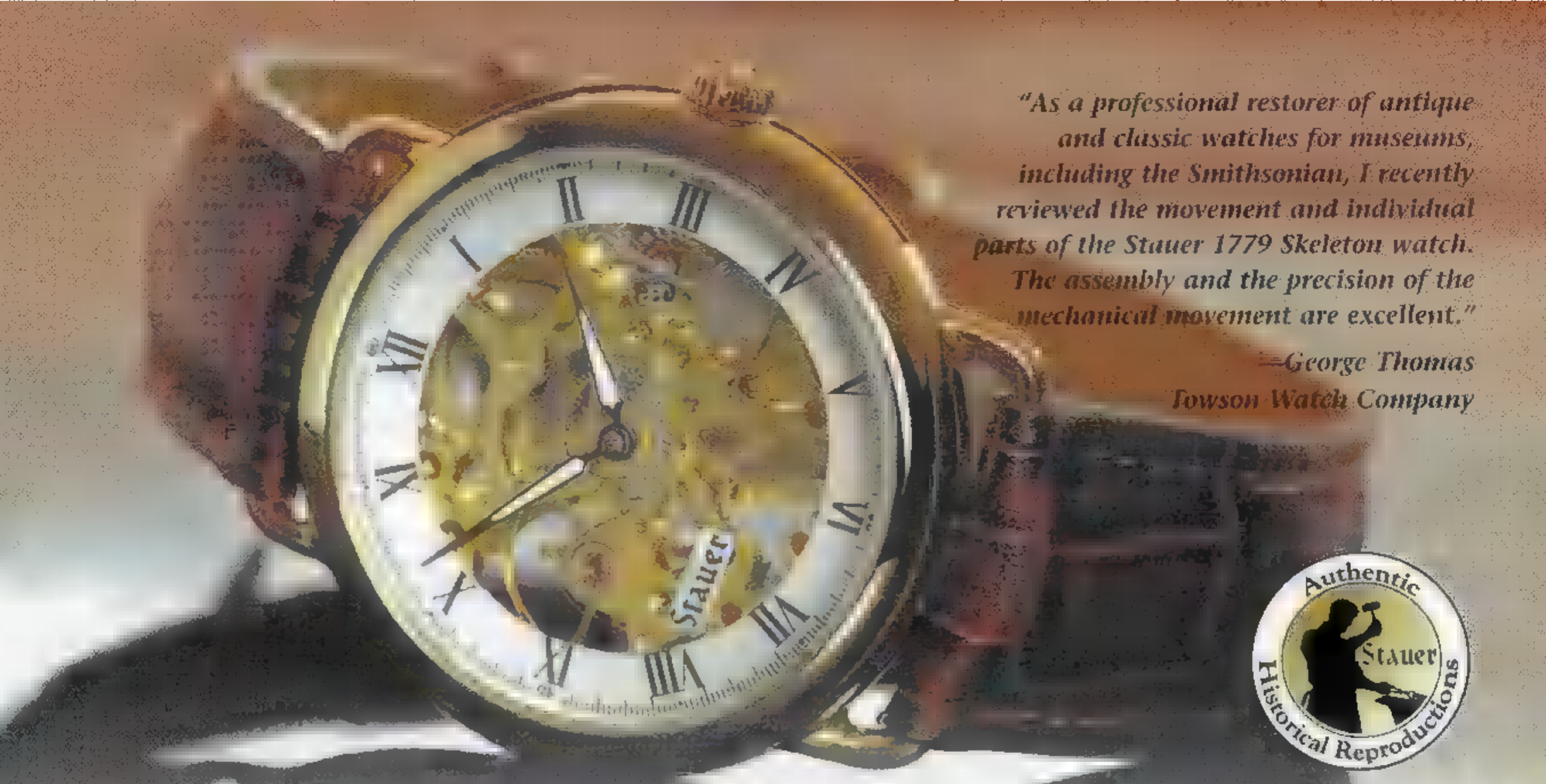




"As a professional restorer of antique and classic watches for museums, including the Smithsonian, I recently reviewed the movement and individual parts of the Stauer 1779 Skeleton watch. The assembly and the precision of the mechanical movement are excellent."

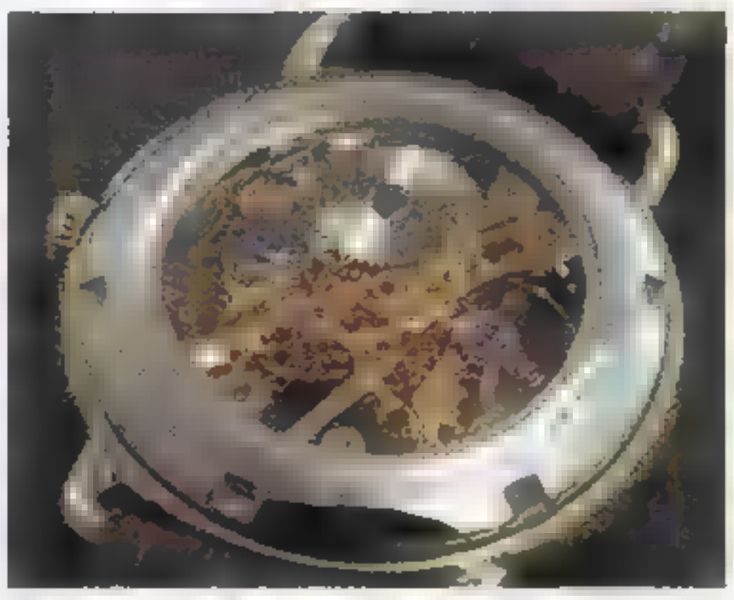
–George Thomas
Towson Watch Company

Authentic Stauer Historical Reproductions

No Bones About It

The Vintage Design of the Stauer 1779 Skeleton Reveals the Precision Inner Workings of a Great Machine.

We found our most interesting watch in our oldest history book. A trip to an antique book store led us to find one of the earliest designs of the sought after skeleton timepiece. With a 227-year-old design, Stauer has brought back the past in the intriguing old world geometry of the Stauer 1779 Skeleton. See right through to the precision parts and hand assembled movement and into the heart of the unique timepiece. It's like seeing an X-Ray inside the handsome gold filled case.



The open exhibition back allows you to further explore the intricate movement and fine craftsmanship.

Beauty is only skin deep but the Engineering Goes Right to the Bone. Intelligent Collectors of vintage mechanical watches have grown bored with mass produced quartz movements. Like fine antique car collectors, they look for authenticity, but they also want practicality from their tiny machines. Inspired by a rare museum piece dating to 1779, we engineered this classic with $31,000,000 worth of precise Swiss built machinery to create the intricate gears and levers. So the historians are thrilled with the authenticity and the demanding engineers are quite impressed with the technical performance.

See All the Way Through. The crystal on the front and the see through exhibition back allow you to observe the gold-fused mainspring, escapement, balance wheel and many of the 20 rubies work in harmony. The balance wheel oscillates at 21,600 times per hour for superb accuracy. The crocodile embossed leather strap adjusts from 6 1/2" to 9" so it will fit practically any wrist. So give it a little wind and the gears roar to life.

The Time Machine. We took the timepiece to George Thomas, a noted historian and watch restorer for museums such as the Smithsonian, and he dissected the 110 parts of the vintage movement. He gave the "1779" top reviews. "It is possible to build it better than the original, and your new skeleton requires so little maintenance." When we shared the price with him, George was stunned. He said that no other luxury skeleton can be had for under $1000. But we pour our money into the watch construction, not into sponsoring yacht races and polo matches. We have been able to keep the price on this collector's limited edition to only three payments of $33.00. So you can wear a piece of watch making history and still keep most of your money in your pocket, not on your wrist. This incredible watch has an attractive price and comes with an exclusive 30-day in-home trial. If you're not completely satisfied with the performance and exquisite detail of this fine timepiece, simply return it for a full refund of your purchase price. There are only 4,999 in the limited edition, so please act quickly. Historical value rarely repeats itself.

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Forbidden Fruit Whether pink or white or ruby red, grapefruit juice and some oral medicines don't mix. The juice can increase the effects—and side effects—of cholesterol-lowering drugs and other medications by up to a factor of ten. Now scientists know why. Grapefruit is loaded with compounds called furanocoumarins. The compounds inhibit an enzyme in the gut that chews up medication before it is absorbed. With the enzyme suppressed, the body absorbs more of the drug. The juice may contain higher levels of the compounds than whole fruit because manufacturers sometimes add furanocoumarin-rich grapefruit oil to boost flavor. The discovery, says researcher Paul Watkins of the University of North Carolina at Chapel Hill, could be used to develop more efficient drugs with more precise dosages. *—Siobhan Roth*

PHOTO: MITCHELL FEINBERG

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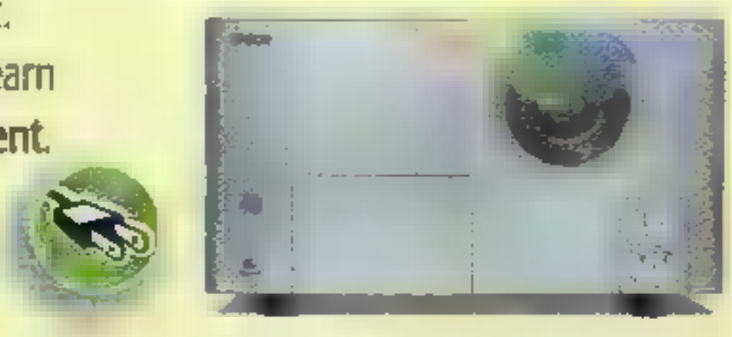
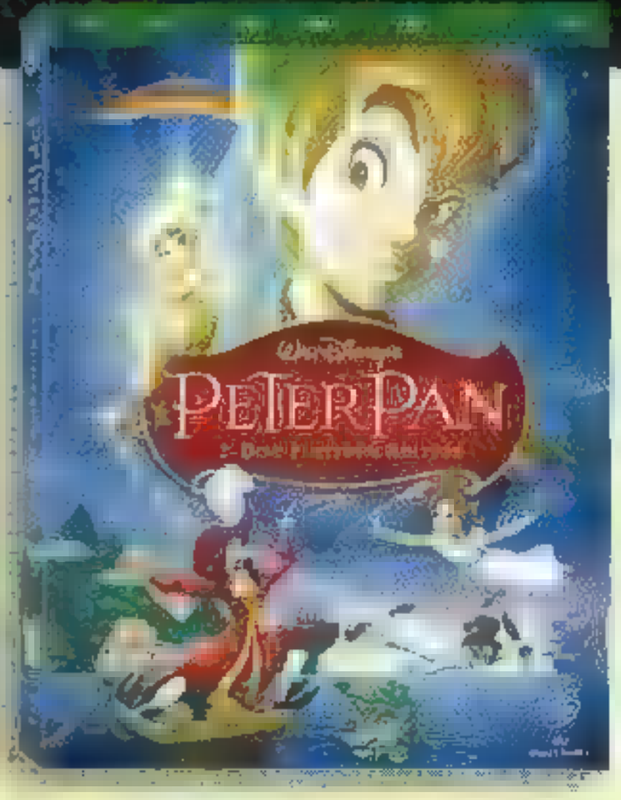


Plug **Load** **Play**

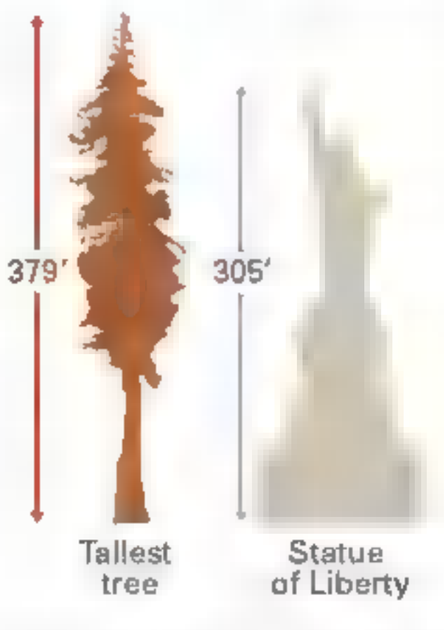


© Disney

First Time on 2-Disc DVD March 6

For a limited time only

Green Giant The world's tallest known tree might have become deck furniture had President Jimmy Carter not expanded Redwood National Park in 1978. Undiscovered and unfelled, the tree lived on in the enlarged sanctuary, and 28 years later, in summer 2006, naturalists Chris Atkins and Michael Taylor found it while exploring an isolated section of the park. The tree, being measured for circumference by biologist Jim C. Spickler (above), pokes its highest branch 379.1 feet above the forest floor. Nicknamed Hyperion, after a Titan in Greek mythology, it bests what had been the tallest known tree, another coast redwood, by more than eight feet.



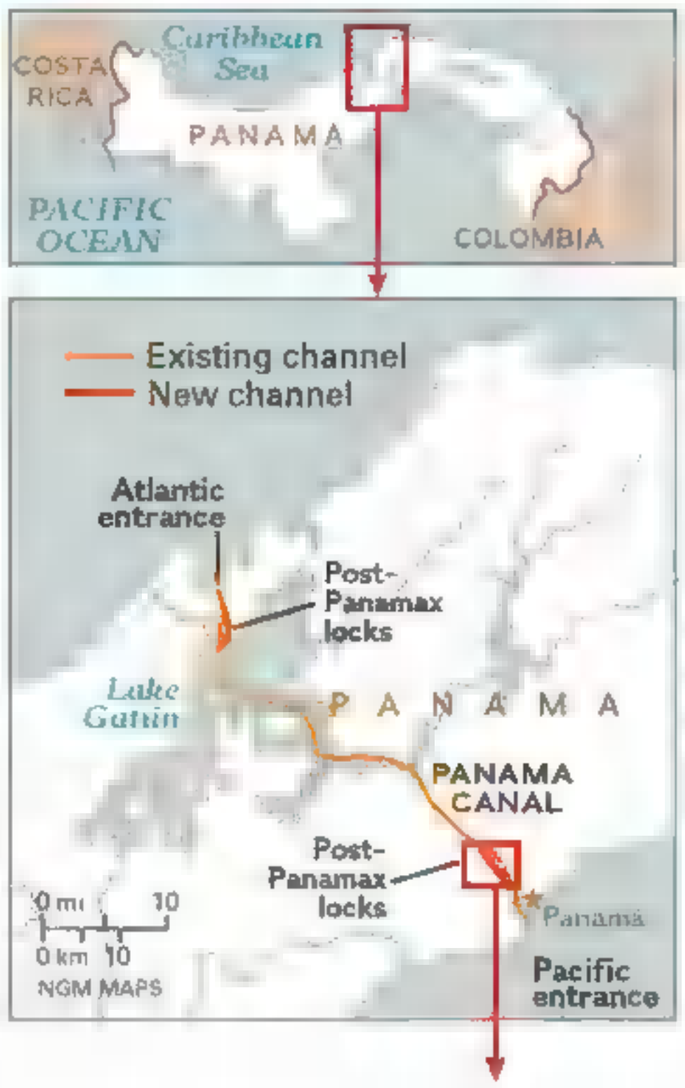
Hyperion was found on a hillside rather than on bottomlands, where redwoods generally grow best. The slope may have protected it from wind and made it relatively inaccessible to loggers, who had already built roads within ■ few hundred feet of the tree when the park was enlarged. Botanist Stephen C. Sillett says redwoods even more titanic may have been clearcut from the nearby bottomlands. Today, it's well-meaning tourists rather than loggers who could harm Hyperion, by compressing the soil at its base—so the tree's location is being kept ■ secret. *—Chris Carroll*

Botanist Stephen C. Sillett stretches for the top of the world's tallest tree —a coast redwood 379.1 feet high.

PHOTOS: PHIL SCHERMEISTER

TECHNOLOGY

Wider, Faster, Busier The Panama Canal was a marvel when it opened in 1914; it's since become a bottleneck. Some vessels may wait days to pass. Huge ships, like those hauling Chinese goods to the U.S. East Coast, exceed the "Panamax" capacity and can't pass through. A 5.25-billion-dollar expansion is planned to create a third lane with bigger locks at the canal's Atlantic and Pacific entrances by 2015. *—Karen E. Lange*

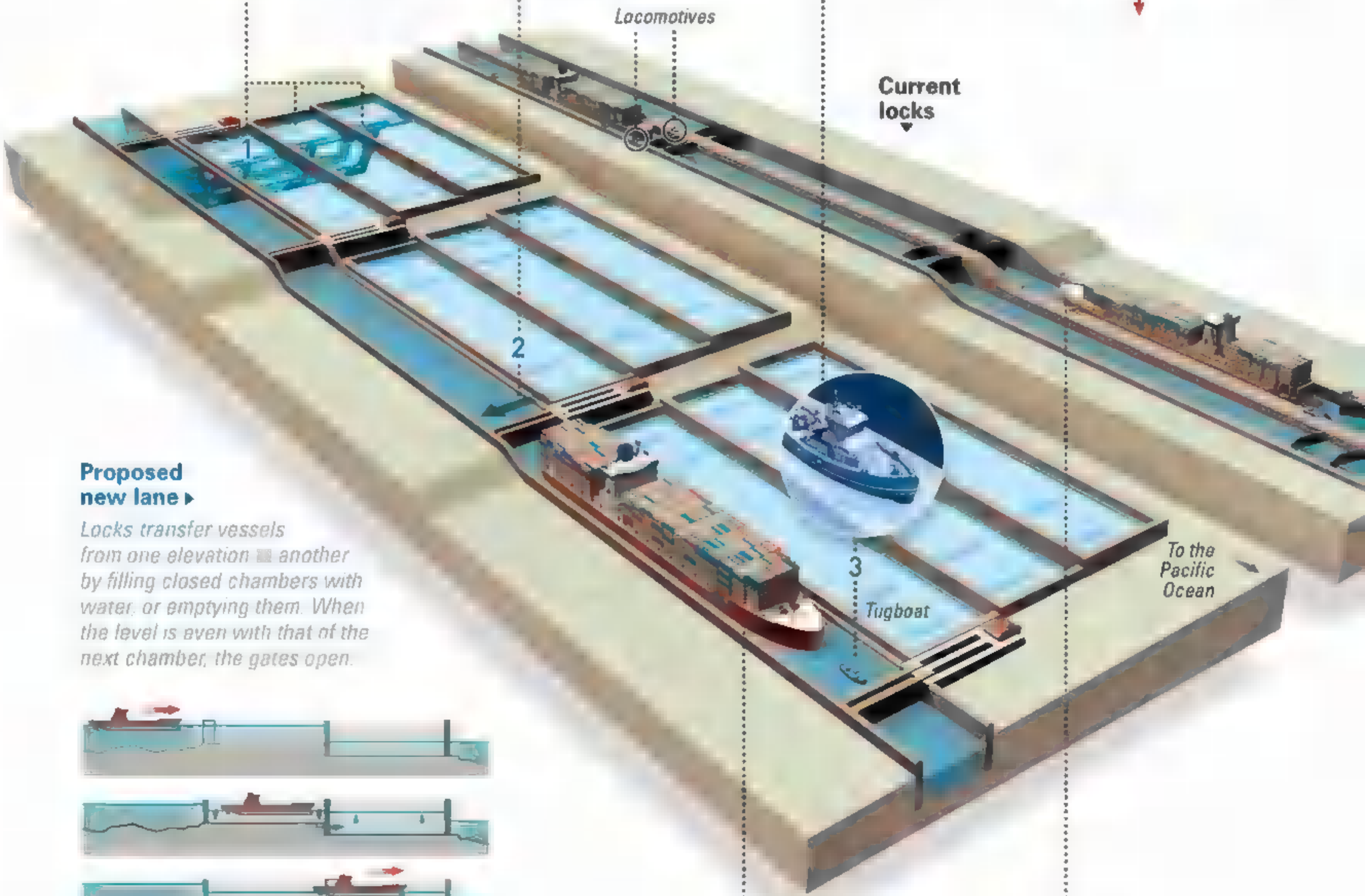


NEW FEATURES

1 Retaining basins fill lock chambers and retain 60 percent of the water for re-use.

2 Rolling lock gates slide into recesses, saving space and making maintenance work much easier.

3 Tugboats maneuver vessels into position, replacing costly towing locomotives.



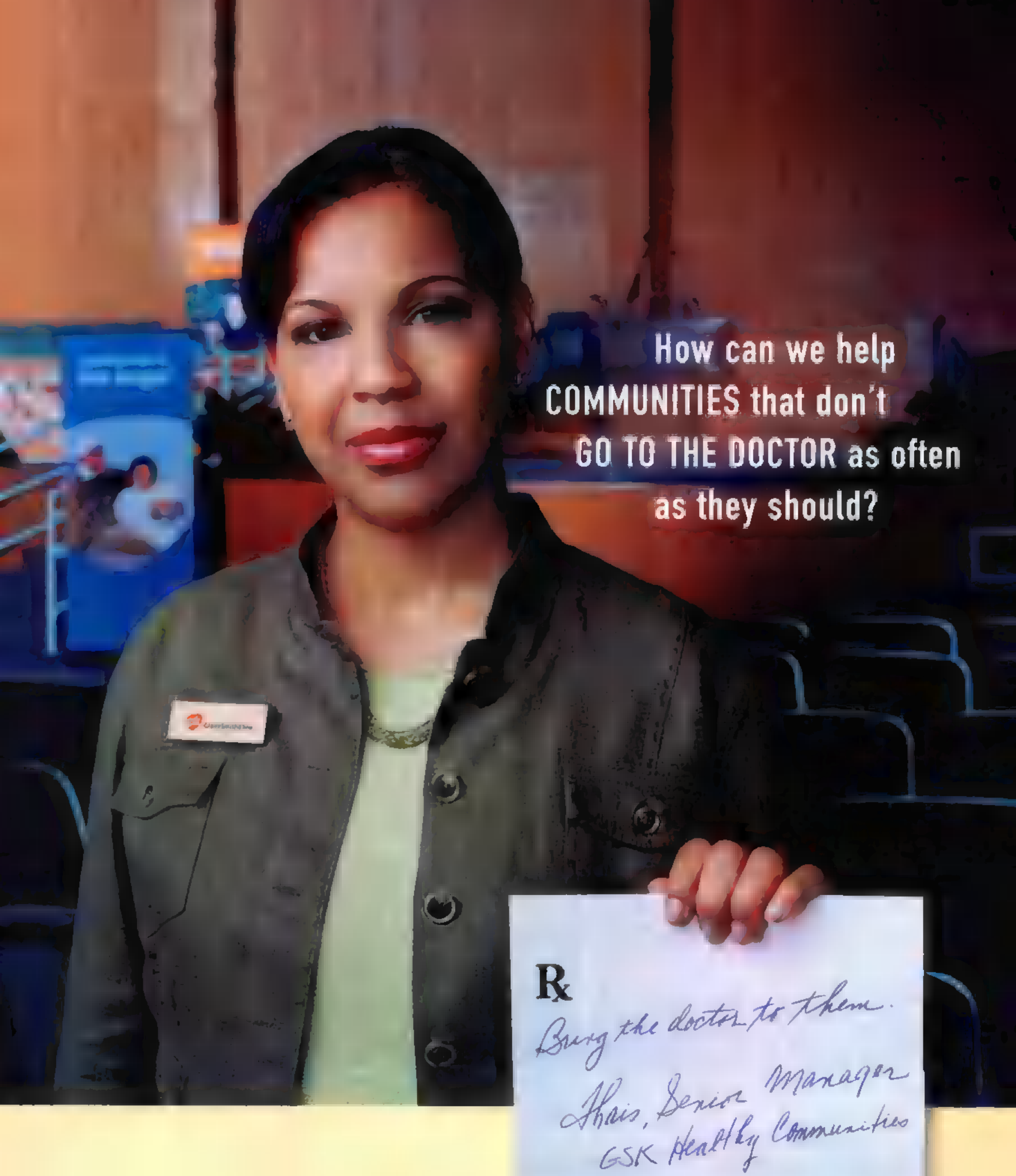
Proposed new lane ▸

Locks transfer vessels from one elevation to another by filling closed chambers with water, or emptying them. When the level is even with that of the next chamber, the gates open.

Adapting to larger ships

The most recent container vessels and tankers are known as post-Panamax. They can hold up to 12,000 containers, 2.5 times the cargo capacity of ships able to fit in the existing locks.

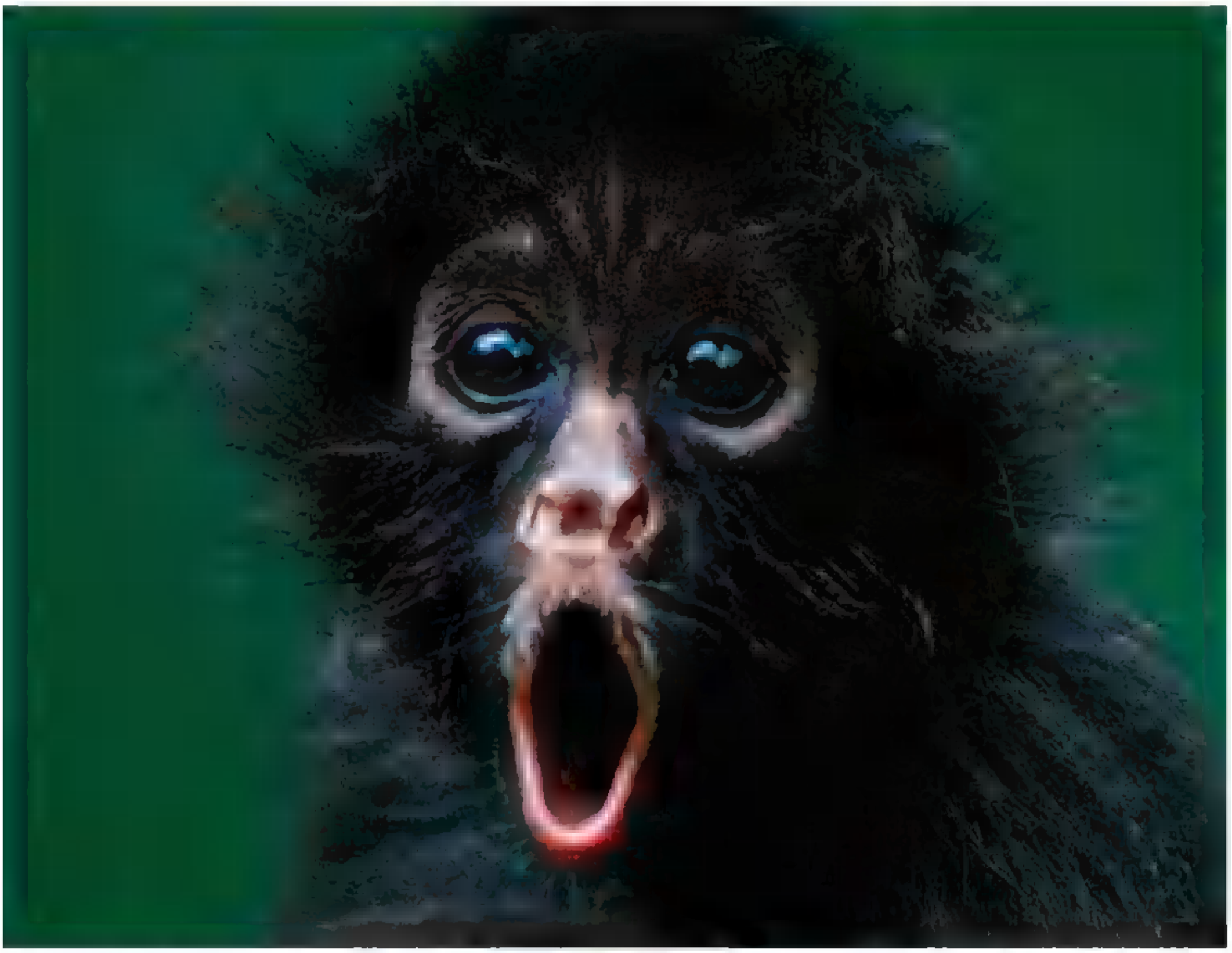
ART: MIKA GRÖNDAHL; SOURCE: PANAMA CANAL AUTHORITY



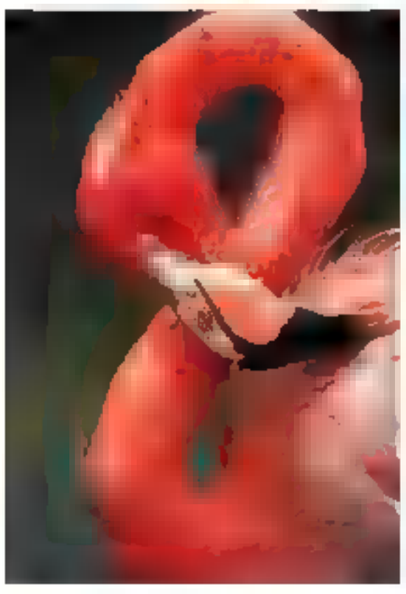
"I SEE real health problems in our communities. Asthma, diabetes, heart disease," says Thais. "And too many folks don't see a doctor in time. So GSK is working with community groups to offer free health screenings and connect local doctors with the people that really need help. That does my heart good, too."

To find out more visit www.gsk-healthycommunities.com

Finding a way forward. GlaxoSmithKline



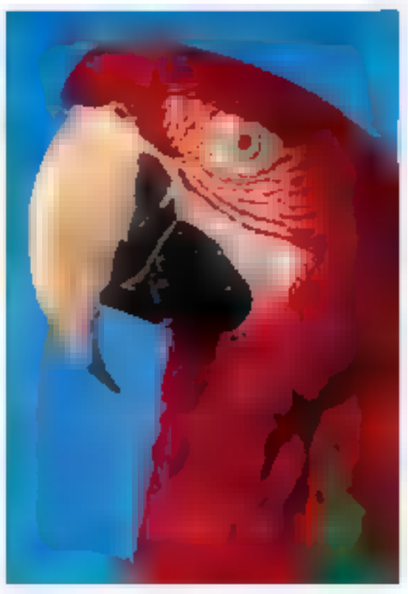
Peruvian spider monkey



Greater flamingo

Leopard tortoise

Golden lion tamarin



Green-winged macaw

American alligator

Stolen Animals

The kidnappers work at night, breaking in as the animals sleep. The next day, keepers find empty enclosures, silence replacing the raucous calls of morning. In the past few years, at least 700 animals have been stolen from European zoos (including the species shown above), apparently to feed increasing demand for rare and exotic pets. Reptiles and birds have always been popular on the European black market, says John Hayward of Britain's National Theft Register for Exotic Animals. In 2000, 28 flamingos were stolen from a French zoo. But demand for tiny primates seems to be on the rise. More than 70 tamarins, marmosets, and other small monkeys have disappeared since 2003. "We'd never seen anything like that," Hayward says. Police have recovered some, but most vanished. Those that survived the heists were likely sold into an animal trafficking web that spans the globe. —*Neil Shea*

PHOTOS (CLOCKWISE FROM TOP): JOEL SARTORE, ART WOLFE, ALTRENDO NATURE, ROINE MAGNUSSON, ALL GETTY IMAGES; WINFRIED WISNIEWSKI, FOTO NATURA/MINDEN PICTURES; RON SANFORD, PHOTO RESEARCHERS

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Eventually it all boils down to: Do I want a car, or do I want a Porsche?

The decision couldn't be more clear-cut. Legendary Porsche handling. A potent, new, 500-hp engine that uses less fuel. And all tightly wrapped in a newly refined, more muscular stance. Now do you want a Cayenne, or did you just want ■ car? Porsche Cayenne Turbo. There is no substitute.

The new Cayenne. Available in March.

PORSCHE

Never Say Die When the British Navy seized the Prussian ship *Henriette* and its cargo of tea and silks in 1803, no one could have guessed that the most enduring of the spoils would be small packets of seeds. Merchant Jan Teerlink had picked them up in southern Africa and stashed them in his red leather notebook (above), which eventually landed in London's national archives. After a researcher discovered them in the book, the archives gave a selection of the seeds to Kew Gardens. "We expected them to be dead," says seed ecologist Matt Daws. But by simulating the southern African climate, Daws and his fellow botanists coaxed life from three of 32 plant species, including a thriving acacia (left). "We can say with confidence," says Daws, "that seeds live a very long time." *—Tom O'Neill*

PHOTOS: ELLY VAES, ROYAL BOTANIC GARDENS, KEW (LEFT); NATIONAL ARCHIVES OF THE UNITED KINGDOM

Men who will become a vice president this year: 13,442

Who will retire before age 60: 940

And reconnect with their younger brother: 83

While drifting down the Amazon: 1

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NG GRANTEE **Crocodile Love** Biologists have long thought that some Morelet's crocodiles in Belize didn't look much like typical Morelet's. Thanks to Texas Tech University's Llewellyn Densmore and his colleagues, they now know why: The crocs are hybrids, the progeny of the mainly freshwater-dwelling Morelet's and American crocodiles, a species found in fresh and salt water. Densmore's research group tested mitochondrial DNA from 140 crocs found in traditional Morelet's haunts and discovered that up to a fifth were Morelet's–American crosses. Crocodiles in captivity are known to interbreed and produce fertile young. Densmore's study is the first genetic evidence that wild Morelet's and American crocs are doing so. *—Karen E. Lange*

Field Notes

Conservationists have been trying to pull New Zealand's kakapo from the brink of extinction for more than ■ century. The green-feathered nocturnal birds are the world's only flightless parrots, and today fewer than 90 of them survive. That they breed only once every two to five years doesn't exactly help the situation. Their breeding cycles seem to correlate with what food they eat. Unclear, though, is how the kakapo's food options changed after A.D. 1250 when humans began settling the islands, disturbing the ecosystems, and whether ■ pre-contact diet might result in more frequent mating. To that end, NG grantee **Mark Horrocks** of Auckland University, in collaboration with Ron Moorhouse and Graeme Elliott of the New Zealand Department of Conservation, is studying fossilized kakapo feces for clues about the bird's original diet. In time, their research may reveal the perfect recipe for revving up the libido of the critically endangered kakapo.

PHOTO: STEPHEN ALVAREZ

Australia

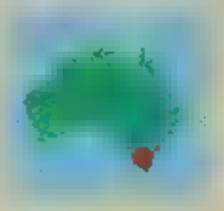
Meet the experts

The Cape Schanck Lighthouse at Mornington Peninsula played a crucial role in Australia's development and is the last one of its kind in Australia. Steve Merson is an expert on the fascinating history of this building—as well as its ghostly inhabitants...

Top: Cape Schanck Lighthouse, with the Bass Strait in the background. Above: The view from the top. Right: Steve waxing lyrical about its history.

Steve Merson

"Historian"



Mornington Peninsula, Victoria

"This lighthouse is littered with ghosts," says Steve Merson. "Between 1800 and 1900, there were more than 300 shipwrecks off the coast here, so it's not surprising."

Steve is no lighthouse keeper, but his life at sea has made him an expert on Australian maritime history—and the Cape Schanck Lighthouse in particular. His first experience of the open waves was when he was shipwrecked aged three, off the Queensland coast, and his dog was eaten by sharks. Later, he ran away to sea with a bunch of fishermen and eventually moved to Thursday Island, where his interest in lighthouses began.

"I suddenly realized that these buildings are more than just blinks in the night—they're fundamental elements of our history. Shipping was crucial to Australia's development—in terms of delivering supplies and trading with other countries. Without lighthouses, our country would not have become what it is today.

"Cape Schanck was one of the most important lighthouses of all. The Bass Strait here, which separates mainland Australia and Tasmania, is a treacherous stretch of water. Before this lighthouse was built, in 1859, ships were losing thousands of tons of cargo a year. Many other lighthouses have long since disappeared. Cape Schanck is one of the last ones remaining."

For more information go to www.nationalgeographic.com/australia

WHERE IN THE WORLD?

Russia's Lena River fans out before reaching the icebound Laptev Sea.

Springtime for Russia Myriad channels lace the delta of the Lena River as it thaws in late spring. The delta juts into the icy Laptev Sea, part of the Arctic Ocean on Siberia's northern coast. The delta's 12,000 or so square miles form the heart of Russia's largest wildlife preserve, where huge expanses of wetland provide habitat for species of summering birds including swans, plovers, snipes, and terns. By October, the Lena and its delta begin to freeze again, suspending animation for the coming eight months. *—Chris Carroll*

PHOTO: EUROPEAN SPACE AGENCY

Jess Jackson, Camelot Highlands Estates, Santa Maria Valley

KENDALL-JACKSON

Winemakers in Burgundy covet this land. The revered Brother Timothy, legendary Christian Brothers winemaker, selected this land as being the perfect place to grow grapes. Why? The unique combination of a cooling fog, calcerous rock and limestone produces grapes with perfect flavor balance.

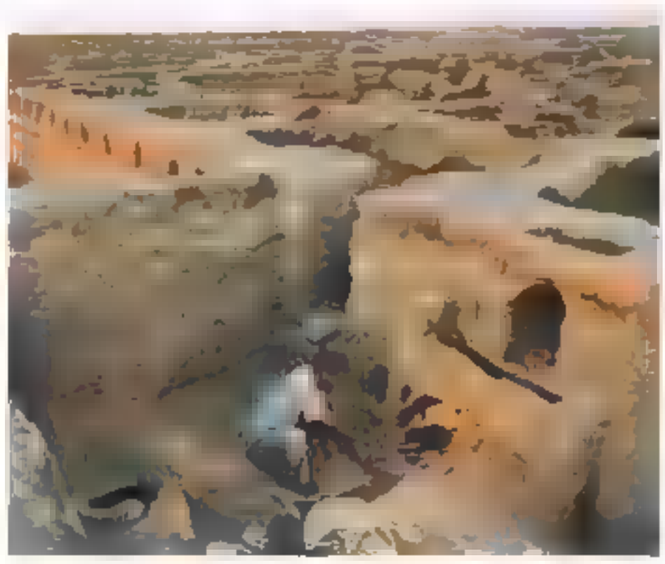
This soil, located in our Camelot Highlands Estates vineyard, is actually uplifted seabed from prehistoric geologic activity. This former seabed provides excellent water drainage. As a result, the vines focus their nutrients and energy on the grapes.

Because of our close proximity to the Pacific Ocean and its famous cool fog, the grapes grown in this prized vineyard enjoy a more leisurely ripening process with longer hangtime on the vine. This allows for phenolic maturity in which all elements of the grape achieve optimal ripening. The reward is a Chardonnay grape with natural tannin, pH, acid and flavor balance. Winemakers in Burgundy grudgingly admit they may see wines like this only once every ten years.

Many of you enjoy the taste of our wines but are not sure why. My goal is to help with **A Taste of the Truth.**

kj.com/truth

Fingertip-size figurines are among the treasures pulled from ruins of the Oxus city of Gonur Depe (bottom).



A Lost Culture Emerges Artifacts found in the ruins of ■ mud-brick city are giving scholars a peek at a civilization that thrived in Central Asia 4,000 years ago. Known as Gonur Depe, the city included some 50 acres of houses and workshops surrounding ■ palace. It was the largest of an archipelago of rich settlements built on irrigated stretches of the Garagum desert. This culture, called the Oxus for the river that nurtured it, arose as Nile, Mesopotamian, and Indus civilizations were flourishing. By 1700 B.C. the water dried up, the people left, and desert sands buried the cities.

During the 1970s, Russian archaeologist Viktor Sarianidi began uncovering Oxus cities, but most Western scholars didn't learn of their existence until the Soviet Union dissolved. "Without Sarianidi this culture probably would still be unknown," says archaeologist Fredrik Hiebert. Gonur Depe's trove of artifacts includes gold jars, lapis and carnelian jewelry, and ■ bronze cart. The recent discovery of a cuneiform seal proves Sarianidi's theory that the Oxus had contact with Mesopotamia. Says Hiebert, "Gonur is helping us grasp how interconnected early civilizations were." *—Peter Gwin*

PHOTOS: KENNETH GARRETT

While Utah has some lovely ski trails, we go for the airbags.

IF YOU LOVE SKIING, CHANCES ARE YOU LOVE UTAH. And we love Utah too, but for a different reason. For us, it's the airbags. Toyota buys airbags from Autoliv in Ogden, Utah. They're terrific partners, one of our hundreds of quality suppliers across the country.

Relationships with suppliers are the lifeblood of our U.S. operations. At Toyota, we purchase more than $28 billion in U.S. parts, materials, goods, and services every year. And whether we are in North Carolina ordering engine sensors, in Michigan buying batteries, in Ohio getting steel, or in Utah picking up airbags, you can be sure of one thing: Toyota is committed to keeping our investment in America strong.

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NG GRANTEE

When Damsels Don't Need Knights

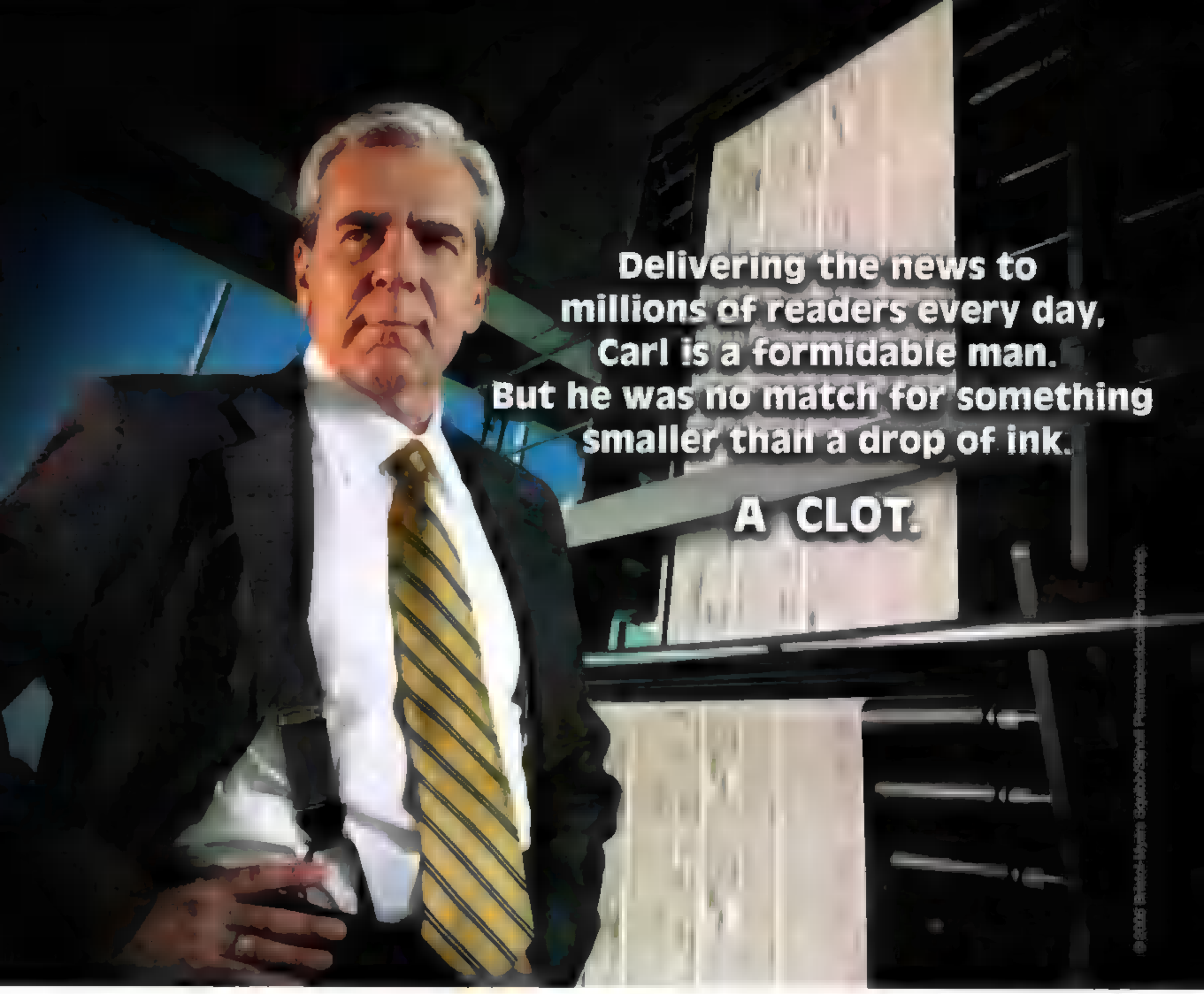
For damselflies the world over, it's virtually the same old story: Males hang out by the watering hole, defending their territory, waiting to pounce on the first female to fly by. Then came the startling report of an all-female damselfly population in the Azores, which arrived in the wake of a study on Fijian species in which females appeared to be on the prowl for mates. "I thought I knew everything about damselflies," says Carleton University biologist Tom Sherratt. "No one had ever seen sex-role reversal before."

Sherratt suspected isolation might be the key, so he and his team staked out streams on Fiji's Viti Levu. Instead of a damselfly dominatrix, they found that adult males were just extremely rare, even though the sex ratio was roughly equal at the larval stage. Sherratt suggests that juvenile males are being killed en masse by a fungal parasite, leaving the females to fend for themselves—perhaps the first step to not needing the males at all. *—Joel K. Bourne, Jr.*

Field Notes

Where was the crucible for the cultures that spawned the Inca Empire? The north Andean highlands and the Pacific coast are candidates. Lake Titicaca, in the southern highlands, has emerged as a contender. NG Fellow **Fredrik Hiebert** recently led a sonar survey of this lake where Bolivia meets Peru, and his findings bolster the Titicaca argument. He scanned a nine-mile-long site just north of the Taraco Peninsula, which juts into the lake from the east and was settled as early as 1500 B.C., almost 3,000 years before the Inca reigned. Penetrating dense sediment, the sonar identified three areas with likely buildings, including one 43-by-30-foot structure. Hiebert now plans to investigate more closely, using divers and remotely operated vehicles.

PHOTO: HANS VAN GOSSUM



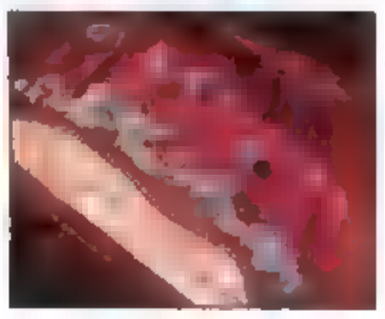
Clots are the number one cause of heart attack and stroke, but you can help reduce your risk.

This is important information if you've been hospitalized with heart-related chest pain or a certain type of heart attack.

That's because these conditions, known as Acute Coronary Syndrome–or ACS –are usually caused when blood platelets stick together and form clots that block blood flow to your heart. And if you've already had a clot, you're at an increased risk for a future heart attack or stroke.

PLAVIX, in combination with aspirin, helps provide greater protection against a future heart attack or stroke than aspirin alone.

PLAVIX, taken with aspirin, plays its own role in helping reduce your risk of heart attack and stroke. That's because, unlike your cholesterol and blood pressure medications, prescription PLAVIX works to help keep blood platelets from sticking together and forming clots.



IMPORTANT INFORMATION: If you have a stomach ulcer or other condition that causes bleeding, you shouldn't use PLAVIX. When taking PLAVIX alone or with some medicines including aspirin, the risk of bleeding may increase. To minimize this risk, talk to your doctor before taking aspirin or other medicines with PLAVIX. Additional rare but serious side effects could occur.

Talk to your doctor today to learn more about PLAVIX.
Or visit www.plavix.com or call 1.800.307.7972.

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(clopidogrel bisulfate) 75mg tablets

BECAUSE YOU'RE NO MATCH FOR A DANGEROUS CLOT.

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Rx only

INDICATIONS AND USAGE

PLAVIX (clopidogrel bisulfate) is indicated for the reduction of atherothrombotic events as follows:

- **Recent MI, Recent Stroke or Established Peripheral Arterial Disease**
  For patients with a history of recent myocardial infarction (MI), recent stroke, or established peripheral arterial disease, PLAVIX has been shown to reduce the rate of a combined endpoint of new ischemic stroke (fatal or not), new ■ (fatal or not), and other vascular death.
- **Acute Coronary Syndrome**
  -For patients with non-ST-segment elevation acute coronary syndrome (unstable angina/ non-Q-wave MI) including patients who are to be managed medically and those who are to be managed with percutaneous coronary intervention (with or without stent) or CABG, PLAVIX has been shown to decrease the rate of a combined endpoint of cardiovascular death, MI, or stroke as well as the rate of a combined endpoint of cardiovascular death, MI, stroke, or refractory ischemia
  -For patients with ST-segment elevation acute myocardial infarction, PLAVIX has been shown to reduce the rate of death from any cause and the rate of a combined endpoint ■ death, re-infarction or stroke. This benefit is not known to pertain to patients who receive primary angioplasty.

CONTRAINDICATIONS

The use of PLAVIX is contraindicated in the following conditions:

- Hypersensitivity to the drug substance or any component of the product.
- Active pathological bleeding such as peptic ulcer or intracranial hemorrhage.

WARNINGS

Thrombotic thrombocytopenic purpura (TTP):

TTP has been reported rarely following use of PLAVIX, sometimes after a short exposure (<2 weeks). TTP is a serious condition that can be fatal and requires urgent treatment including plasmapheresis (plasma exchange). It is characterized by thrombocytopenia, microangiopathic hemolytic anemia (schistocytes [fragmented RBCs] seen on peripheral smear), neurological findings, renal dysfunction, and fever. (See **ADVERSE REACTIONS**.)

PRECAUTIONS

General

PLAVIX prolongs the bleeding time and therefore should be used with caution in patients who may be at risk of increased bleeding from trauma, surgery, or other pathological conditions (particularly gastrointestinal and intraocular). If a patient is to undergo elective surgery and an antiplatelet effect is not desired, PLAVIX should be discontinued 5 days prior to surgery.

Due to the risk of bleeding and undesirable hematological effects, blood cell count determination and/or other appropriate testing should be promptly considered, whenever such suspected clinical symptoms arise during the course of treatment (see **ADVERSE REACTIONS**).

In patients with recent TIA or stroke who are at high risk for recurrent ischemic events, the combination of aspirin and PLAVIX has not been shown to be more effective than PLAVIX alone, but the combination has been shown to increase major bleeding.

GI Bleeding: In CAPRIE, PLAVIX was associated with a rate of gastrointestinal bleeding of 2.0%, vs. 2.7% on aspirin. In CURE, the incidence of major gastrointestinal bleeding was 1.3% vs 0.7% (PLAVIX + aspirin vs. placebo + aspirin, respectively). PLAVIX should be used with caution in patients who have lesions with a propensity to bleed (such as ulcers). Drugs that might induce such lesions should be used with caution in patients taking PLAVIX.

Use in Hepatically Impaired Patients: Experience is limited in patients with severe hepatic disease, who may have bleeding diatheses. PLAVIX should be used with caution in this population.

Use in Renally-impaired Patients: Experience is limited ■ patients with severe renal impairment. PLAVIX should be used with caution in this population.

Information for Patients

Patients should be told it may take them longer than usual to stop bleeding, that they may bruise and/or bleed more easily when they take PLAVIX or PLAVIX combined with aspirin, and that they should report any unusual bleeding to their physician. Patients should inform physicians and dentists that they are taking PLAVIX and/or any other product known to affect bleeding before any surgery is scheduled and before any new drug is taken.

Drug Interactions

Study of specific drug interactions yielded the following results:

Aspirin: Aspirin did not modify the clopidogrel-mediated inhibition of ADP-induced platelet aggregation. Concomitant administration of 500 mg of aspirin twice a day for 1 day did not significantly increase the prolongation of bleeding time induced by PLAVIX. PLAVIX potentiated the effect of aspirin on collagen-induced platelet aggregation. PLAVIX and aspirin have been administered together for up to one year.

Heparin: In a study in healthy volunteers, PLAVIX did not necessitate modification of the heparin dose or alter the effect of heparin on coagulation. Coadministration of heparin had no effect on inhibition of platelet aggregation induced by PLAVIX.

Nonsteroidal Anti-Inflammatory Drugs (NSAIDs): In healthy volunteers receiving naproxen, concomitant administration of PLAVIX was associated with increased occult gastrointestinal blood loss. NSAIDs and PLAVIX should be coadministered with caution.

Warfarin: Because of the increased risk of bleeding, the concomitant administration of warfarin with PLAVIX should be undertaken with caution. (See **PRECAUTIONS– General.**)

Other Concomitant Therapy: No clinically significant pharmacodynamic interactions were observed when PLAVIX was coadministered with **atenolol, nifedipine,** or both atenolol and nifedipine. The pharmacodynamic activity of PLAVIX was also not significantly influenced by the coadministration of **phenobarbital, cimetidine** or **estrogen.**

The pharmacokinetics of **digoxin** or **theophylline** were not modified by the coadministration of PLAVIX (clopidogrel bisulfate).

At high concentrations *in vitro*, clopidogrel inhibits P_{450} (2C9). Accordingly, PLAVIX may interfere with the metabolism of **phenytoin, tamoxifen, tolbutamide, warfarin, torsemide, fluvastatin,** and many **non-steroidal anti-inflammatory agents**, but there are no data with which to predict the magnitude of these interactions. Caution should be used when any of these drugs ■ coadministered with PLAVIX.

In addition to the above specific interaction studies, patients entered into clinical trials with PLAVIX received a variety of concomitant medications including **diuretics, beta-blocking agents, angiotensin converting enzyme inhibitors, calcium antagonists, cholesterol lowering agents, coronary vasodilators, antidiabetic agents** (including **insulin**), **thrombolytics, heparins** (unfractionated and LMWH) **GPIIb/IIIa antagonists, antiepileptic agents** and **hormone replacement therapy** without evidence of clinically significant adverse interactions.

There are no data on the concomitant use of oral anticoagulants, non-study oral anti-platelet drugs and chronic NSAIDs with clopidogrel.

Drug/Laboratory Test Interactions

None known.

Carcinogenesis, Mutagenesis, Impairment of Fertility

There was no evidence of tumorigenicity when clopidogrel was administered for 78 weeks to mice and 104 weeks to rats at dosages up to 77 mg/kg per day, which afforded plasma exposures >25 times that in humans at the recommended daily dose of 75 mg.

Clopidogrel was not genotoxic in four *in vitro* tests (Ames test, DNA-repair test in rat hepatocytes, gene mutation assay in Chinese hamster fibroblasts, and metaphase chromosome analysis of human lymphocytes) and in one *in vivo* test (micronucleus test by oral route in mice).

Clopidogrel was found to have no effect on fertility of male and female rats at oral doses up to 400 mg/kg per day (52 times the recommended human dose on a mg/m² basis).

Pregnancy

Pregnancy Category B. Reproduction studies performed in rats and rabbits at doses up to 500 and 300 mg/kg/day (respectively, 65 and 78 times the recommended daily human dose on a mg/m² basis), revealed no evidence of impaired fertility or fetotoxicity due to clopidogrel. There are, however, no adequate and well-controlled studies in pregnant women. Because animal reproduction studies are not always predictive of a human response, PLAVIX should be used during pregnancy only if clearly needed.

Nursing Mothers

Studies in rats have shown that clopidogrel and/or its metabolites are excreted in the milk. It is not known whether this drug is excreted in human milk. Because many drugs are excreted in human milk and because of the potential for serious adverse reactions in nursing infants, a decision should be made whether to discontinue nursing or to discontinue the drug, taking into account the importance of the drug to the nursing woman.

Pediatric Use

Safety and effectiveness in the pediatric population have not been established.

Geriatric Use

Of the total number of subjects in CAPRIE, CURE and CLARITY controlled clinical studies, approximately 50% of patients treated with PLAVIX were 65 years of age and older and 15% were 75 years and older. In COMMIT, approximately 58% of the patients treated with PLAVIX were 60 years and older, 26% of whom were 70 years and older.

The observed risk of thrombotic events with clopidogrel plus aspirin versus placebo plus aspirin by age category is provided in Figures 3 and 6 for the CURE and COMMIT trials, respectively (see **CLINICAL STUDIES**). The observed risk of bleeding events with clopidogrel plus aspirin versus placebo plus aspirin by age category is provided in Tables 5 and 6 for the CURE and COMMIT trials, respectively (see **ADVERSE REACTIONS**).

ADVERSE REACTIONS

PLAVIX has been evaluated for safety in more than 42,000 patients, including over 9,000 patients treated for 1 year or more. The clinically important adverse events observed in CAPRIE, CURE, CLARITY and COMMIT are discussed below.

The overall tolerability of PLAVIX in CAPRIE was similar to that of aspirin regardless of age, gender and race, with an approximately equal incidence (13%) of patients withdrawing from treatment because of adverse reactions.

Hemorrhagic: In CAPRIE patients receiving PLAVIX, gastrointestinal hemorrhage occurred at a rate of 2.0%, and required hospitalization in 0.7%. In patients receiving aspirin, the corresponding rates were 2.7% and 1.1%, respectively. The incidence of intracranial hemorrhage was 0.4% for PLAVIX compared to 0.5% for aspirin.

In CURE, PLAVIX use with aspirin was associated with an increase in bleeding compared to placebo with aspirin (see Table 5). There was an excess in major bleeding in patients receiving PLAVIX plus aspirin compared with placebo plus aspirin, primarily gastrointestinal and at puncture sites. The incidence of intracranial hemorrhage (0.1%), and fatal bleeding (0.2%), were the same in both groups.

The overall incidence of bleeding is described in Table 5 for patients receiving both PLAVIX and aspirin in CURE.

Table 5: CURE Incidence of bleeding complications (% patients)

Event	PLAVIX (+ aspirin)* (n=6259)	Placebo (+ aspirin)* (n=6303)	P-value
Major bleeding †	3.7 ‡	2.7 §	0.001
Life-threatening bleeding	2.2	1.8	0.13
Fatal	0.2	0.2	
5 g/dL hemoglobin drop	0.9	0.9	
Requiring surgical intervention	0.7	0.7	
Hemorrhagic strokes	0.1	0.1	
Requiring inotropes	0.5	0.5	
Requiring transfusion (≥4 units)	1.2	1.0	
Other major bleeding	1.6	1.0	0.005
Significantly disabling	0.4	0.3	
Intraocular bleeding with significant loss of vision	0.05	0.03	
Requiring 2-3 units of blood	1.3	0.9	
Minor bleeding ¶	5.1	2.4	<0.001

* Other standard therapies were used as appropriate.

† Life threatening and other major bleeding.

‡ Major bleeding event rate for PLAVIX + aspirin was dose-dependent on aspirin: <100 mg=2.6%; 100-200 mg= 3.5%; >200 mg=4.9%
Major bleeding event rates for PLAVIX + aspirin by age were: <65 years = 2.5%, ≥65 to <75 years = 4.1%, ≥75 years 5.9%

§ Major bleeding event rate for placebo + aspirin was dose-dependent on aspirin: <100 mg=2.0%; 100-200 mg= 2.3%; >200 mg=4.0%
Major bleeding event rates for placebo + aspirin by age were: <65 years = 2.1%, ≥65 to <75 years = 3.1%, ≥75 years 3.6%

¶ Led to interruption of study medication.

Ninety-two percent (92%) of the patients in the CURE study received heparin/LMWH, and the rate of bleeding in these patients was similar to the overall results.

There was no excess in major bleeds within seven days after coronary bypass graft surgery in patients who stopped therapy more than five days prior to surgery (event rate 4.4% PLAVIX + aspirin; 5.3% placebo + aspirin). In patients who remained on therapy within five days of bypass graft surgery, the event rate was 9.6% for PLAVIX + aspirin, and 6.3% for placebo + aspirin.

In CLARITY, the incidence of major bleeding (defined as intracranial bleeding or bleeding associated with a fall in hemoglobin > 5 g/dL) was similar between groups (1.3% versus 1.1% in the PLAVIX + aspirin and in the placebo + aspirin groups, respectively). This was consistent across subgroups of patients defined by baseline characteristics, and type of fibrinolytics or heparin therapy. The incidence of fatal bleeding (0.8% versus 0.6% in the PLAVIX + aspirin and in the placebo + aspirin groups, respectively) and intracranial hemorrhage (0.5% versus 0.7%, respectively) was low and similar in both groups.

The overall rate of noncerebral major bleeding or cerebral bleeding in COMMIT was low and similar in both groups as shown in Table 6 below.

Table 6: Number (%) of Patients with Bleeding Events in COMMIT

Type of bleeding	PLAVIX (+ aspirin) (N = 22961)	Placebo (+ aspirin) (N = 22891)	P-value
Major* noncerebral or cerebral bleeding**	134 (0.6%)	125 (0.5%)	0.59
Major noncerebral	82 (0.4%)	73 (0.3%)	0.48
Fatal	36 (0.2%)	37 (0.2%)	0.90
Hemorrhagic stroke	55 (0.2%)	56 (0.2%)	0.91
Fatal	39 (0.2%)	41 (0.2%)	0.81
Other noncerebral bleeding (non-major)	831 (3.6%)	721 (3.1%)	0.005
Any noncerebral bleeding	896 (3.9%)	777 (3.4%)	0.004

* Major bleeds are cerebral bleeds or non-cerebral bleeds thought to have caused death or that required transfusion.

** The relative rate of major noncerebral or cerebral bleeding was independent of age. Event rates for PLAVIX + aspirin by age were: <60 years = 0.3%, ≥60 to <70 years = 0.7%, ≥70 years 0.8%. Event rates for placebo + aspirin by age were: <60 years = 0.4%, ≥60 to <70 years = 0.6%, ≥70 years 0.7%.

Adverse events occurring ■ ≥2.5% of patients on PLAVIX in the CAPRIE controlled clinical trial are shown below regardless of relationship to PLAVIX. The median duration of therapy was 20 months, with a maximum of 3 years.

Table 7: Adverse Events Occurring in ≥2.5% of PLAVIX Patients in CAPRIE

	% Incidence (% Discontinuation)	
Body System **Event**	**PLAVIX [n=9599]**	**Aspirin [n=9586]**
Body as a Whole – general disorders		
Chest Pain	8.3 (0.2)	■ (0.3)
Accidental/Inflicted Injury	7.9 (0.1)	7.3 (0.1)
Influenza-like symptoms	7.5 (<0.1)	7.0 (<0.1)
Pain	6.4 (0.1)	6.3 (0.1)
Fatigue	3.3 (0.1)	3.4 (0.1)
Cardiovascular disorders, general		
Edema	4.1 (<0.1)	4.5 (<0.1)
Hypertension	4.3 (<0.1)	5.1 (<0.1)
Central & peripheral nervous system disorders		
Headache	7.6 (0.3)	7.2 (0.2)
Dizziness	6.2 (0.2)	6.7 (0.3)
Gastrointestinal system disorders		
Any event	27.1(3.2)	29.8 (4.0)
Abdominal pain	5.6 (0.7)	7.1 (1.0)
Dyspepsia	5.2 (0.6)	6.1 (0.7)
Diarrhea	4.5 (0.4)	3.4 (0.3)
Nausea	3.4 (0.5)	3.8 (0.4)
Metabolic & nutritional disorders		
Hypercholesterolemia	4.0 (0)	4.4 (<0.1)
Musculo-skeletal system disorders		
Arthralgia	6.3 (0.1)	6.2 (0.1)
Back Pain	5.8 (0.1)	5.3 (<0.1)
Platelet, bleeding, & clotting disorders		
Purpura/Bruise	5.3 (0.3)	3.7 (0.1)
Epistaxis	2.9 (0.2)	2.5 (0.1)
Psychiatric disorders		
Depression	3.6 (0.1)	3.9 (0.2)
Respiratory system disorders		
Upper resp tract infection	8.7 (<0.1)	8.3 (<0.1)
Dyspnea	4.5 (0.1)	4.7 (0.1)
Rhinitis	4.2 (0.1)	4.2 (<0.1)
Bronchitis	3.7 (0.1)	3.7 (0)
Coughing	3.1 (<0.1)	2.7(<0.1)
Skin & appendage disorders		
Any event	15.8 (1.5)	13.1 (0.8)
Rash	4.2 (0.5)	3.5 (0.2)
Pruritus	3.3 (0.3)	1.6 (0.1)
Urinary system disorders		
Urinary tract infection	3.1 (0)	3.5 (0.1)

No additional clinically relevant events to those observed in CAPRIE with a frequency ≥2.5%, have been reported during the CURE and CLARITY controlled studies. COMMIT collected only limited safety data.

Other adverse experiences of potential importance occurring in 1% to 2.5% of patients receiving PLAVIX (clopidogrel bisulfate) in the controlled clinical trials are listed below regardless of relationship to PLAVIX. In general, the incidence of these events was similar to that in patients receiving aspirin (in CAPRIE) or placebo + aspirin (in the other clinical trials).

Autonomic Nervous System Disorders: Syncope, Palpitation. *Body as a Whole-general disorders:* Asthenia, Fever, Hernia. *Cardiovascular disorders:* Cardiac failure. *Central and peripheral nervous system disorders:* Cramps legs, Hypoaesthesia, Neuralgia, Paraesthesia, Vertigo. *Gastrointestinal system disorders:* Constipation, Vomiting. *Heart rate and rhythm disorders:* Fibrillation atrial. *Liver and biliary system disorders:* Hepatic enzymes increased. *Metabolic and nutritional disorders:* Gout, hyperuricemia, non-protein nitrogen (NPN) increased. *Musculo-skeletal system disorders:* Arthritis, Arthrosis. *Platelet, bleeding & clotting disorders:* ■ hemorrhage, hematoma, platelets decreased. *Psychiatric disorders:* Anxiety, Insomnia. *Red blood cell disorders:* Anemia. *Respiratory system disorders:* Pneumonia, Sinusitis. *Skin and appendage disorders:* Eczema, Skin ulceration. *Urinary system disorders:* Cystitis. *Vision disorders:* Cataract, Conjunctivitis.

Other potentially serious adverse events which may be of clinical interest but were rarely reported (<1%) in patients who received PLAVIX in the controlled clinical trials are listed below regardless of relationship to PLAVIX. In general, the incidence of these events was similar to that in patients receiving aspirin (in the other clinical trials).

Body as a whole: Allergic reaction, necrosis ischemic. *Cardiovascular disorders:* Edema generalized. *Gastrointestinal system disorders:* Peptic, gastric or duodenal ulcer, gastritis, gastric ulcer perforated, gastritis hemorrhagic, upper ■ ulcer hemorrhagic. *Liver and Biliary system disorders:* Bilirubinemia, hepatitis infectious, liver fatty. *Platelet, bleeding and clotting disorders:* hemarthrosis, hematuria, hemoptysis, hemorrhage intracranial, hemorrhage retroperitoneal, hemorrhage of operative wound, ocular hemorrhage, pulmonary hemorrhage, purpura allergic, thrombocytopenia. *Red blood cell disorders:* Anemia aplastic, anemia hypochromic. *Reproductive disorders, female:* Menorrhagia. *Respiratory system disorders:* Hemothorax. *Skin and appendage disorders:* Bullous eruption, rash erythematous, rash maculopapular, urticaria. *Urinary system disorders:* Abnormal renal function, acute renal failure. *White cell and reticuloendothelial system disorders:* Agranulocytosis, granulocytopenia, leukemia, leukopenia, neutropenia.

Postmarketing Experience

The following events have been reported spontaneously from worldwide postmarketing experience:

- *Body as a whole:*
  -hypersensitivity reactions, anaphylactoid reactions, serum sickness
- *Central and Peripheral Nervous System disorders:*
  -confusion, hallucinations, taste disorders
- *Hepato-biliary disorders:*
  -abnormal liver function test, hepatitis (non-infectious), acute liver failure
- *Platelet, Bleeding and Clotting disorders:*
  -cases of bleeding with fatal outcome (especially intracranial, gastrointestinal and retroperitoneal hemorrhage)
  -thrombotic thrombocytopenic purpura (TTP) – some cases with fatal outcome- (see **WARNINGS**).
  -agranulocytosis, aplastic anemia/pancytopenia
  -conjunctival, ocular and retinal bleeding
- *Respiratory, thoracic and mediastinal disorders:*
  -bronchospasm, interstitial pneumonitis
- *Skin and subcutaneous tissue disorders:*
  -angioedema, erythema multiforme, Stevens-Johnson syndrome, toxic epidermal necrolysis, lichen planus
- *Renal and urinary disorders:*
  - glomerulopathy, increased creatinine levels
- *Vascular disorders:*
  - vasculitis, hypotension
- *Gastrointestinal disorders:*
  - colitis (including ulcerative or lymphocytic colitis), pancreatitis, stomatitis
- *Musculoskeletal, connective tissue and bone disorders:*
  - myalgia

OVERDOSAGE

Overdose following clopidogrel administration may lead to prolonged bleeding time and subsequent bleeding complications. A single oral dose of clopidogrel at 1500 or 2000 mg/kg was lethal to mice and to rats and at 3000 mg/kg to baboons. Symptoms of acute toxicity were vomiting (in baboons), prostration, difficult breathing, and gastrointestinal hemorrhage in all species.

Recommendations About Specific Treatment:

Based on biological plausibility, platelet transfusion may be appropriate to reverse the pharmacological effects of PLAVIX if quick reversal is required.

DOSAGE AND ADMINISTRATION

Recent MI, Recent Stroke, or Established Peripheral Arterial Disease

The recommended daily dose ■ PLAVIX is 75 mg once daily.

Acute Coronary Syndrome

For patients with non-ST-segment elevation acute coronary syndrome (unstable angina/non-Q-wave MI), PLAVIX should be initiated with a single 300 mg loading dose and then continued at 75 mg once daily. Aspirin (75 mg-325 mg once daily) should be initiated and continued in combination with PLAVIX. In CURE, most patients with Acute Coronary Syndrome also received heparin acutely (see **CLINICAL STUDIES**).

For patients with ST-segment elevation acute myocardial infarction, the recommended dose of PLAVIX is 75 mg once daily, administered in combination with aspirin, with or without thrombolytics. PLAVIX may be initiated with or without a loading dose (300 mg was used in CLARITY; see **CLINICAL STUDIES**).

PLAVIX can be administered with or without food.

No dosage adjustment is necessary for elderly patients or patients with renal disease. (See **Clinical Pharmacology: Special Populations.**)

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Brief Summary of Prescribing Information Revised August 2006
PLA-AUG06-B-Ae

A female chinook salmon digs her redd, or nest, prior to spawning in Oregon's John Day River.

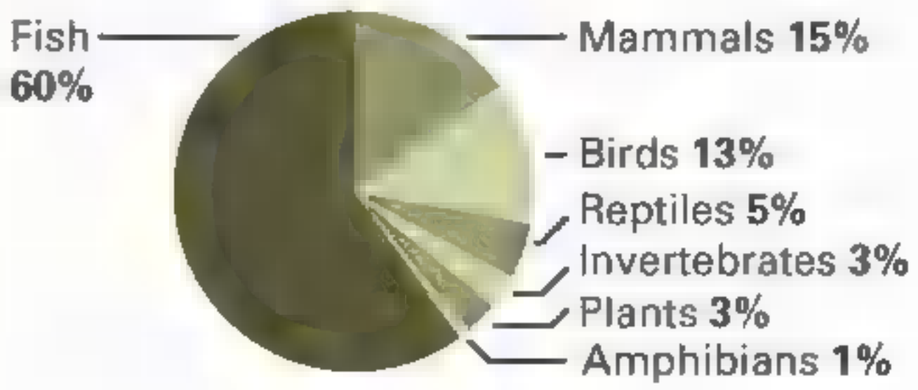
Fishes' Riches Pacific Northwest salmon are swimming in money. Is it enough to save them? Federal and state agencies spent 1.4 billion dollars in 2004 to protect 1,271 threatened and endangered species. Most of the top-ten expenditures went to fish, for measures that include securing their hatching areas. The spending, says Valerie Fellows of the U.S. Fish and Wildlife Service, is a fair barometer of public and congressional interest. National Marine Fisheries Service's Brian Gorman adds, "Salmon have huge commercial value. They've been an icon and a food source out here since before Lewis and Clark arrived." *—Michael Klesius*

THE BIG TEN

SPECIES WITH THE MOST MONETARY SUPPORT, FISCAL YEAR 2004

Chinook salmon	$161,309,500
Steelhead	117,380,400
Steller sea lion	42,557,300
Coho salmon	36,648,200
Bull trout	32,570,600
Sockeye salmon	21,827,600
Red-cockaded woodpecker	14,125,100
Pallid sturgeon	13,370,200
Chum salmon	13,257,900
Right whale	12,369,600

TOTAL SPENDING, 2004

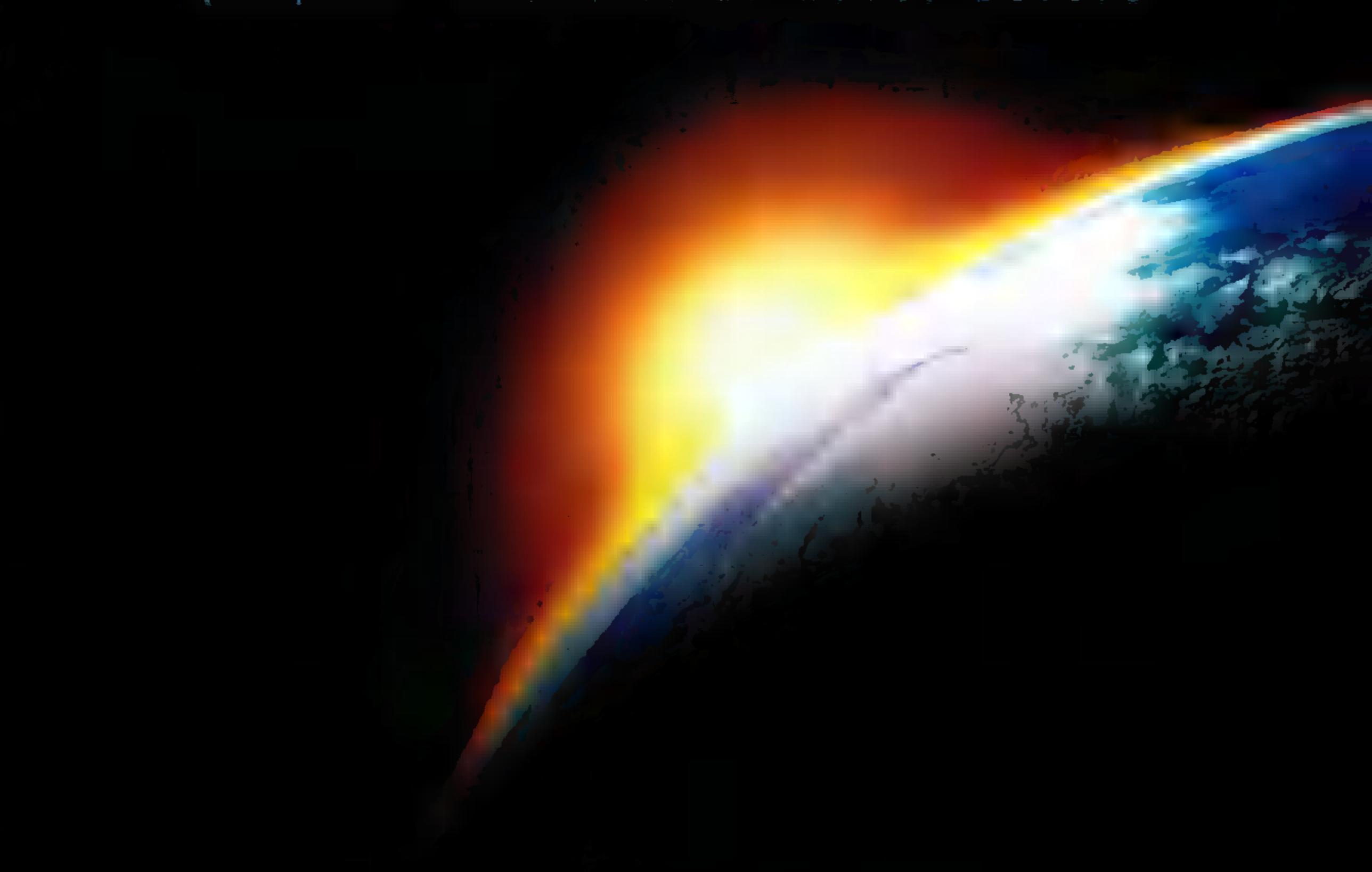


SOURCE: U.S. FISH AND WILDLIFE SERVICE. PHOTO: JIM RICHARDSON

"SHOT LIKE A MASTERPIECE—ADVANCES IN TECHNOLOGY HAVE ALLOWED THE WORLD TO BE FRAMED MORE BEAUTIFULLY THAN EVER BEFORE." *—THE SUNDAY TIMES*

planet earth

prepare to see it as never before



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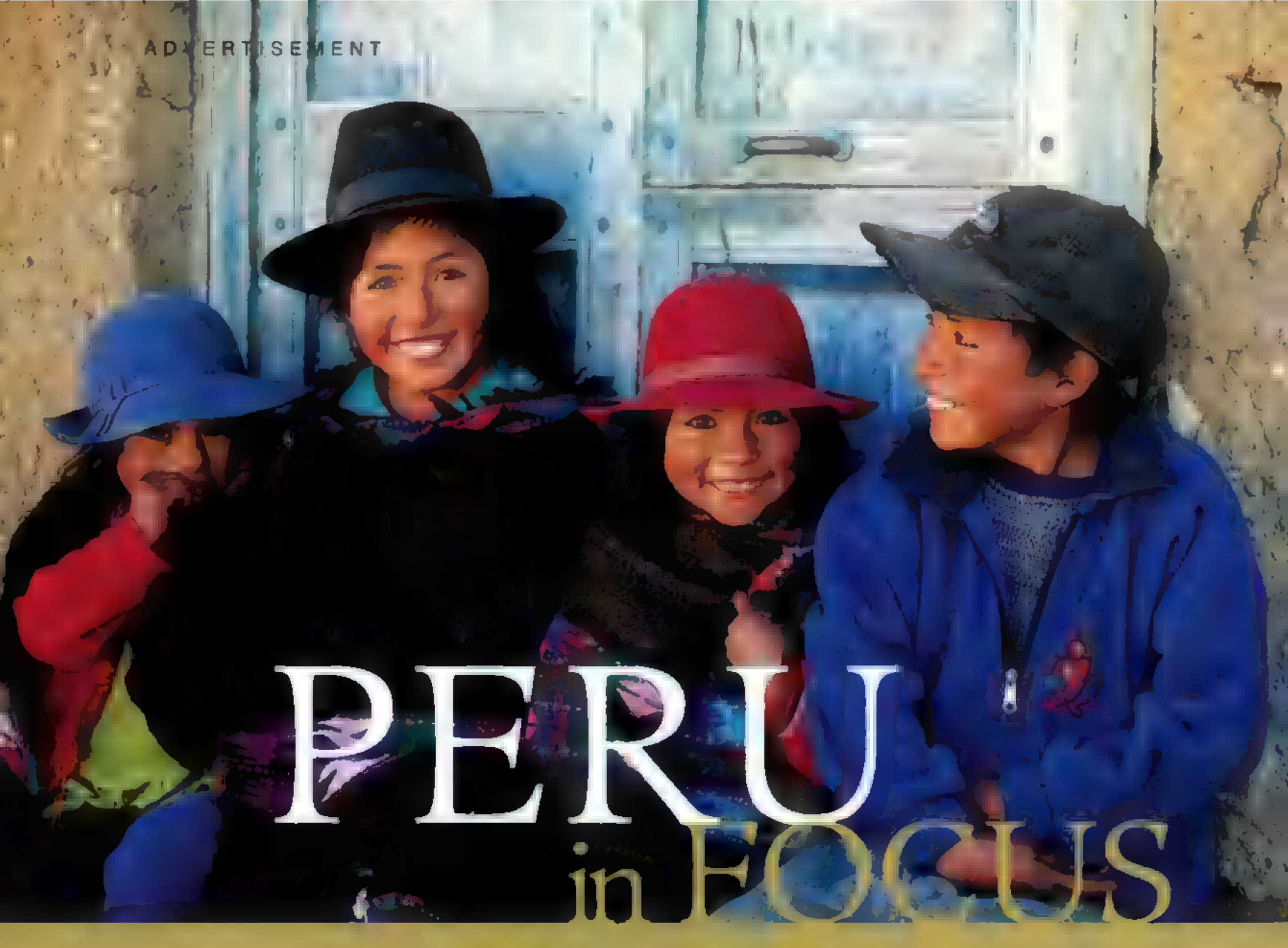

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BOB KRIST

Kaleidoscope: The Colors of Peru

MIAMI ✦ DATE: APRIL 2007

SAN FRANCISCO ✦ DATE: OCTOBER 2007

An acclaimed photographer for *National Geographic Traveler* and engaging storyteller, Bob Krist will take you on his personal journey through Peru. His remarkable images reveal the vivid colors of this vibrant country, bringing to life Peru's history culture, arts, and the majestic Machu Picchu.

WADE DAVIS

Adventure: Peru

WASHINGTON, DC ✦ DATE: MAY 2007

National Geographic Society Explorer-In-Residence and anthropologist Wade Davis spent three years in remote Amazon rain forests and Andean mountain villages, immersed in Peru's unique traditions and way of life. Join him as he shares his adventures exploring the heart of a vastly different culture.

KARIN MULLER

Mystery of the Incas

NEW YORK CITY, NY ✦ DATE: JUNE 2007

LOS ANGELES ✦ DATE: SEPTEMBER 2007

Karin Muller, a National Geographic Society explorer, set off on a seven-month odyssey to one of the wonders of the ancient world—Peru's legendary Inca Road. See highlights of her amazing four-thousand mile expedition, following in the footsteps of a vanished civilization.

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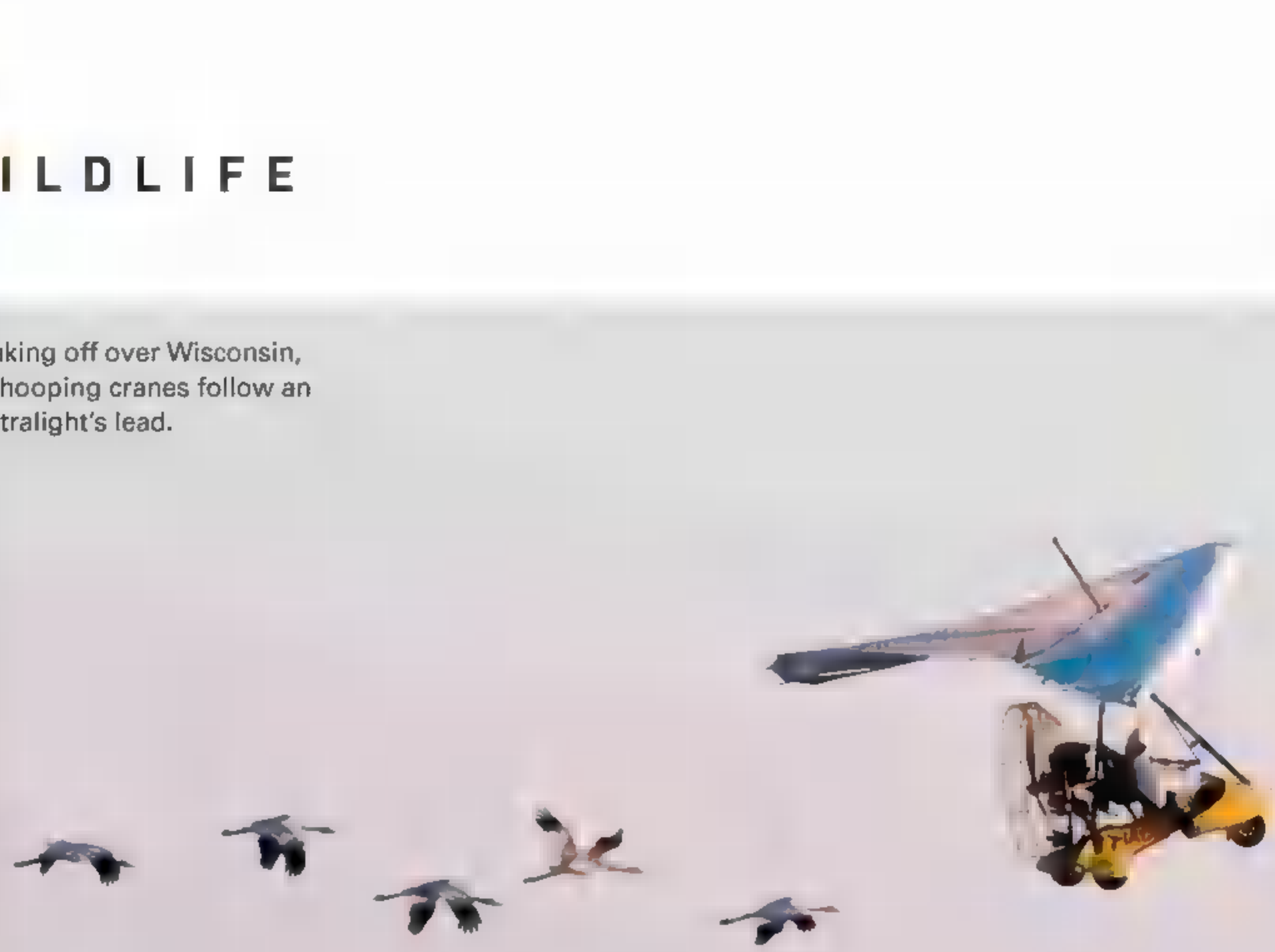
Taking off over Wisconsin, whooping cranes follow an ultralight's lead.



Winged Victory The whoosh of wingbeats overhead is another flock of whooping cranes fleeing extinction. In one of conservation's greatest successes, a species hammered down to 21 individuals by hunting and habitat loss in the 1940s has rebounded to 500.

Tapping into cranes' instinct to follow the leader, the staff of Operation Migration, part of the Whooping Crane Eastern Partnership, trains captive-bred whoopers to follow ultralight planes as they naturally would their parents. Pilots lead the birds 1,250 miles from a refuge in Necedah, Wisconsin, to wintering grounds on Florida's Gulf Coast. In subsequent years, the educated birds migrate on their own. A wild chick born to captive-bred parents joined the journey for the first time in 2006. Once the wild population can sustain itself, conservationists hope to pull the ultralights, leaving the birds to nature's course.

The trip takes two months and four planes—one to lead and three to circle back after stragglers—while researchers monitor the birds from the ground. On that autumn morning when the birds first take flight into the rising sun, the view is like a dream: Long necks and stretched wings shadow a yellow flying machine, heading home.

—Jennifer S. Holland

PHOTO: REBECCA HALE, NGS PHOTOGRAPHER

While poachers are slaughtering some of the last surviving central African elephants for their tusks, a refuge in Chad gives this endangered species armed protection—and a fighting chance. Conservationist J. MICHAEL FAY and photographer MICHAEL NICHOLS report from the front lines.

IVORY WARS

LAST STAND IN ZAKOUMA

Slaking their thirst at a dry season water hole on the Salamat River, elephants in Zakouma National Park have flourished, with their numbers growing from 1,100 to around 3,500 during the past 21 years. Outside the park, the scene is not so benign.

Skin and bones are all that remain of the 20 elephants killed last May just outside the southern border of Zakouma National Park. Poachers hauled away the ivory, leaving park officials with an ongoing challenge: How to protect herds that wander beyond the park's protective umbrella.

When one matriarch searches for food in the Zakouma, a herd of 800 elephants follows in behind. Wise old females, responsible for the well-being of family groups, know every trail and creek crossing, every village and road. They know where dangers lie, and where to find the best forage.

The dead elephant, a huge bull, lay on his side, right leg curled as if in wrenching pain. Dirt covered the exposed eye—magic done by poachers to hide the carcass from vultures. The smell of musth and urine, of fresh death, hung over the mound of the corpse. It was a sight I had seen hundreds of times in central Africa. As I passed my hand over his body from trunk to tail, tears poured down my cheeks. I lifted the bull's ear. Lines of bright red blood bubbled and streamed from his lips, pooling in the dust. His skin was checkered with wrinkles. The base of his trunk was as thick as a man's torso. Deep fissures ran like rivers through the soles of his feet; in those lines, I could trace every step he had taken during his 30 years of life.

This elephant's ancestors had survived centuries of raiding by the armies of Arab and African sultans from the north in search of slaves and ivory. He had lived through civil wars and droughts, only to be killed today for a few pounds of ivory to satisfy human vanity in some distant land. There were tender blades of grass in his mouth. He and his friends had been peacefully roaming in the shaded forest, snapping branches filled with sweet gum. Then, the first gunshot exploded. He bolted, too late. Horses overtook him. Again and again, bullets pummeled his body. We counted eight small holes in his head. Bullets had penetrated the thick skin and lodged in muscle, bone, and brain before he fell. We heard 48 shots before we found him.

Souleyman Mando, the commander of our detachment of mounted park rangers, was silent. I sensed a dark need for revenge. The feeling was mutual.

"Next time, you will get them," I offered.

He feigned a smile. "*Inshallah*," he said.

In Zakouma National Park, antipoaching is dangerous business. Officially, guards are allowed to defend themselves if poachers shoot. Unofficially, it is shoot-to-kill on both sides, so better to be the first to pull the trigger. In the

ARMED GUARDS PATROL ZAKOUMA, BUT THEY'RE OUTNUMBERED BY POACHERS—AND OUTGUNNED.

The commander of our detachment of mounted park rangers was silent. I sensed a dark need for revenge. "Next time, you will get them," I offered.

past eight years, six guards have been killed by poachers, and at least six poachers by guards.

I asked Souleyman how many shots he had fired. Three, he said. The others—Adoum, Yacoub, Issa, Attim, Brahim, Saleh, and Abdoulaye—had fired 21 shots. Still, the two poachers, whom Souleyman identified as Arab nomads, had escaped on horseback with their AK-47 and M14 assault rifles. There was a second pair of horsemen, too. Adoum had fired at them before they disappeared. No doubt, there was another wounded elephant, fleeing in frantic terror.

There is little love lost between our ragtag fighting force—a mix of sedentary tribesmen from local villages, some Arab, most Muslim—and the mounted Arab nomads who are the main culprits in the killing of Zakouma's elephants. Souleyman contemplated tracking the poachers, but now his men had a new obsession: ivory. Finding ivory in the bush provokes a fever in most Africans I have known; the guards, dedicated as they were to protecting the park, were no different.

By now, other guards had joined us, and pity for the dead bull gave way to a frenetic chopping of tusks. Taking a knife, Ndjongo sliced the rough gray armor of the inch-thick hide covering the trunk, revealing a layer of white gristle and dark muscle. As the knife worked deeper, two tubular nostrils, pure white and smooth as enamel, came into view; hours before, they had siphoned fresh water from a pool. He threw the severed trunk aside like a slain serpent. Then, with an ax, he chopped at the flat plate of face bone. His back bore the sheen of sweat as he chipped away for nearly an hour. Extracting a deeply embedded conical tooth—easily marred by a stray blow—was precise, delicate work. Every so often, he tested to see if the tusk was loose. Finally, he pulled hard, and with a loud, painful crack, the tusk broke free from tons of flesh and bone.

Souleyman grabbed the tusk and shook it. The root slid to the ground like a squid. He stuffed the tusk cavity with straw to preserve the shape of the hollow base. Ndjongo began to chop the second tooth from the skull. This ivory was all the men had to show for four days of hard pursuit to protect the park, and it wasn't even theirs to keep. It would be locked away at headquarters in a depot filled with a growing pile of confiscated tusks. Ivory taken by poachers either follows a path from the bush to regional cities such as Khartoum and Douala, where it is sold as sculptures and jewelry, or finds its way to Asia through a network of black market traders.

Souleyman cut an ear off the elephant, laid it on a donkey's back as a pad, and strapped the tusks down tightly. The men saddled up, and we headed out by way of Bahr Béhéda, a desiccated tributary of the Salamat River. To the south, we saw vultures soaring. By now, that second elephant had probably stumbled and fallen, but the men lacked the energy to search it out. It was midday in late May 2006, with the temperature hovering at 115°F, and we still had four hours of hard going to reach base.

In the dry season, the landscape of Zakouma National Park in southeastern Chad holds a nomad's treasure—the first permanent water south of the Sahara, where the Korom, Tinga, and Béhéda Rivers meet the Salamat. Somehow, despite a tumultuous history of slavery, colonialism, and civil war, humans have found a place in their hearts to make a refuge for wildlife here. Even today, as refugees stream into Chad from Sudan to escape the chaos in Darfur, 200 miles to the east, elephants live in Zakouma in relative peace. The natural world persists in abundance, while thousands of our own are dying.

But Zakouma is tiny, not even 1,200 square miles, and every year as the dry season relaxes its grip, some 3,500 elephants leave the park to find better forage. Danger awaits them. In a Texas-size region stretching from southern Sudan, southeastern Chad, and eastern Central African Republic down to the edge of the Congo forests, humans have been responsible for a precipitous decline of elephants, from perhaps 300,000 in the early 1970s to some 10,000 today.

Society Grant This Expeditions Council project is supported by your Society membership.

In Zakouma in the past eight years, six guards have been killed by poachers, and at least six poachers by guards.

MARCH 23, 2006 It had been a year since my last visit to Zakouma, but, flying in my Cessna over the Chadian landscape with photographer Michael "Nick" Nichols, I recognized the park by the meanders of dry riverbeds dotted with occasional pools. We descended into the heat of the brown floodplain of the Salamat River. At a thousand feet, I spied an elephant standing under a large *Terminalia* tree. Circling lower, we saw elephants—hundreds—crowded under the shade of just about every tree in view, motionless save for the gentle flapping of ears to cool their bodies. Zakouma is the last place on Earth where you can see more than a thousand elephants on the move in a single, compact herd.

Nick spotted the Zakouma base camp. Radio antennas, satellite dishes, and a fleet of trucks and heavy equipment attested to a well-greased infrastructure—a secure island in a sea of human entropy.

Before landing, I wanted to show Nick the largest of the water holes, Rigueik, that act as magnets to life in the dry season. Flying east, we made a low pass over the pool as thousands of cranes, pelicans, spur-winged geese, and storks unfolded their black-and-white wings and took flight. A herd of buffalo—there must have been more than 600—fled south in a golden cloud of dust. Hundreds of topi, hartebeests, waterbuck, kob, reedbuck, and giraffes raced in a wave below. In the clearing, we also saw the half-eaten carcass of a juvenile elephant.

We touched down at base camp and were warmly greeted by a throng of kids and Luis Arranz, a Spanish employee of the European Union who has worked here for six years. (For the past 17 years, the EU has donated nearly a million dollars a year to the Zakouma conservation project.) Tiny circles pocked the dusty ground—there had been a "mango rain," a light shower, in the night. We immediately started talking about the elephants, wondering if these first raindrops had got them moving. Luis assured me that the full-blown rainy season wouldn't come until June and that the elephants hadn't yet congregated. I asked about the dead elephant we'd seen at Rigueik. He said it had been killed and eaten by lions a few days before.

MARCH 24 After setting up camp south of headquarters, at Tinga, a refurbished tourist camp, we sat down with Luis and his team to discuss plans. We were here to observe the elephants during the seasonal metamorphosis from barren desert to verdant pasture. Back in 2000, Malachie Dolmia, a friend now working for Chad's Ministry of Water and Environment, had put satellite tracking collars on several Zakouma elephants while doing his Ph.D. He discovered that when the wet season begins, elephants leave the park apparently in two subpopulations, one ranging about 60 miles north, the other traveling about the same distance southwest. We wanted to find out what triggers the gathering of these big groups, whether they leave Zakouma at the same time, and, most important, how vulnerable the elephants are to poaching during the four to five months they're outside the park.

APRIL 4 Our first task: an aerial survey of Zakouma. I would pilot the Cessna, and Pierre Poilecot, a French biologist who runs the park's ecological monitoring program, would be the front-seat observer and data logger, with Étienne Ngakoutou and Nicolas Taloua in the rear. This was to be a repeat of a survey we did the previous dry season, when we counted 3,885 elephants. Pierre's truck rumbled into camp at 3:30 a.m., sending millions of roosting queleas, finch-like birds, into a diluvian frenzy of flapping wings and chirping. A baboon reacted from his elevated night perch—*hoon, hoon, hoooon*. At daybreak, we were flying 300 feet above the vast confluence of floodplains that

AFTER POACHERS HACKED THE FACE OFF A 20-YEAR-OLD ELEPHANT, PARK GUARDS (ABOVE) WERE LEFT WITH FEW CLUES AND A COLD TRAIL.

The elephant's face had been chopped off, his tusks gone. We camped with this fellow for three days, mourning him.

define Zakouma, back and forth on transect lines like a crop duster, counting animals.

On the first pass, we were in the thick of it. Nicolas called out, "elephant, 8, left," and Étienne, "roan antelope, 1, right." It continued like that: giraffe 3, giraffe 1, hartebeest 5, elephant 4, giraffe 4, giraffe 14, buffalo 3, buffalo 1, buffalo 65, elephant—a herd. I looked down: Five groups were loosely assembled on the savanna. We counted 175 elephants in all. By the time we landed, four hours later, we had tallied 4,205 animals: 2,063 buffalo, 952 elephants, 551 hartebeests, 301 topi, 194 giraffes, 74 waterbuck, 45 ostriches, and 25 roan antelope. Not a bad accounting for the first morning.

APRIL 8 By our last survey day, the numbers were looking good for all species except the elephant. Pierre arrived at my tent at 4:37 a.m. I opened the truck door and reached into the side pocket of my backpack to grab my headlamp. An insanely intense pain seared my right thumb. As I yanked my hand back, I felt a large, hard arthropod of some sort. Pierre blurted out, "Scorpion!" By the time we got to the plane, my arm was throbbing and covered in a cold sweat. I tried pulling on the controls, but it was useless. Mahamat, the night watchman, came to the rescue. He examined the sting, then started to rub it hard with a scrap of wood given to him by a Sudanese witch doctor. With each rub, a funny-bone sensation shot up my arm. Howling, I let him continue—maybe the exorcism would work. I spent the next four hours in a fetal position in my sleeping bag repeating the mantra: "You will look in your sack before you put your hand into it in the dark. You will look. . . ."

Later that afternoon, I mustered the will for an overdue chat with Abakar Abdel Ali, the park's longest serving guard and the son of the chief of the former village of Zakouma, one of several Arab settlements whose people once fished and grew sorghum along the Salamat River. Abakar had been a young man in 1958 when his father agreed to a proposal by a French civil servant to turn the area around the village into a reserve where hunting was *(Continued on page 54)*


Park guards will look up these
tusks, but the man who killed the
elephant got away. Seizures of
illegal ivory reached record levels
in 2005. In China—the fastest
growing consumer—dealers sell
marked ivory on the Internet,
slipping it undetected

COUNTING ELEPHANTS

To get numbers that measure the scale of elephant poaching, Mike Fay crisscrossed Zakouma and vicinity by air. Although his findings (at right) are geographically limited, they highlight a broader point: Armed guards in the park are a deterrent to poaching, but overall these elephants are dangerously vulnerable.

0 mi 10
0 km 10

SOURCE: J. MICHAEL FAY, CONSERVATIONIST, WILDLIFE CONSERVATION SOCIETY; EXPLORER-IN-RESIDENCE, NATIONAL GEOGRAPHIC SOCIETY

ART BY OLIVER UBERTI

MARGUERITE B. HUNSIKER AND JAMES E. McCLELLAND, JR., NGM MAPS

ELEPHANTS OBSERVED MAY–OCT. 2006

ELEPHANT COUNT

ALIVE — DEAD

1 5 20 100 500 1,000 — 1 5 20

— Elephant track sighting
– – Aerial survey route
▫ Village

ANNIE KILLED
August 15

ANNIE COLLARED
May 23

Karom
Andouma water hole
Zakouma base camp
Rigueik water hole
Machtour water hole
Tinga camp
Bekolo
Annie's route
ZAKOUMA NATIONAL PARK
Ibir
Bon
Kiéké
Am Timan
Lake Iro
Sulamat
C H A D

ANNIE'S LAST TREK

To track the migration of herds in and around Zakouma, researchers have fitted elephants with collars equipped with GPS transmitters. One elephant, named Annie, took off on an 86-day, 1,015-mile trek (red line) before being killed by poachers north of the park.

THE DANGEROUS SEASON

In May, when the heavy rains start, elephants leave the park to seek better forage; they return by October. Beyond the jurisdiction of Zakouma's armed patrols live clans of Arab nomads who survive by herding cattle—and poaching elephants.

Arab nomads herd cattle near the park in the dry season. When the rains come, the herders move with—and target—the elephants.

A HEAVY TOLL

During the 2006 wet season, 100 elephants killed by poachers were found outside the park, and 27 inside. In defending the sanctuary, six armed guards have been shot and killed in the past eight years. "Our biggest problem," says park administrator Luis Arranz, "is we don't have enough guns and ammunition."

banned. Five years later, Abakar witnessed the creation of Zakouma National Park. The forecast was full of promise: Wildlife would flourish, tourists would come. But first Zakouma and seven other villages had to be razed and their occupants, who received compensation and the promise of employment, moved outside the refuge. Abakar started working for Zakouma in 1969 and, the next year, became a guard. At that time, buffalo were almost extinct in the park, and there were about a thousand elephants. There are now 6,500 buffalo, and elephant numbers have steadily increased since the ban on international ivory trade in 1989, reaching 3,885 in 2005.

Do the resettled villagers support the park? Abakar paused. "They don't care about its importance as a reserve for wildlife. They regret not being able to exploit it." I asked him if the park's future seemed secure. He replied, "If there is money, the park will exist. The park has been good for wildlife." Indeed, as our surveys show, Zakouma has been nothing short of a miracle for wildlife. You can fly for hours in any direction outside the park and find no place else with such abundance.

Hearing our voices, the two cubs emitted high-pitched growls and squeals. They wrestled and tumbled, not knowing that without their mother, they were now members of the living dead.

APRIL 9 With my hand functional again, we were back in action. The final elephant count was 127 herds, with a total of 3,020 animals, almost 900 short of last year. Luis was perplexed. Had we missed a large herd, or had we double-counted a herd in 2005? I had no reason to believe that the drop reflected an increase in poaching. In 1985, I'd participated in a survey, led by Iain Douglas-Hamilton, of the range of elephants in the northern part of the Central African Republic, that yielded a disastrous ratio of live elephants (4,308) to carcasses (7,861). Our dry season survey in Zakouma revealed not even one-tenth that level of poaching.

APRIL 10 The days were scorching and clear. We moved camp to a big water hole on the Tinga, upstream of its junction with the Salamat, pitching our tents just below a low bridge built across four steel culverts. At the end of the dry season, this pool, jade green on a thick bed of sand, had the sweetest water in the entire park. A black kite, dipping its wings and inclining its tail ever so slightly, circled, eyes fixed on the queleas that were spilling onto the water's edge, drinking. A flock of guinea fowl came to the bank, clucking cautiously as they alternated between searching the ground for seeds and checking the sky for aerial predators. In the pool, the mouths of thousands of whiskered catfish dimpled the surface like water striders.

Then, it happened. Elephants appeared on the edge of the bank, juveniles first, followed by a large female. They stood still, listening. The female nudged one of the young males forward. He resisted at first, but thirst and a mother's insistence drove him down the bank. Other elephants followed, pouring down the steep incline, 30 to 40 of them, babies in tow, heads bobbing from side to side. At the water, they dropped their trunks into the coolness, taking deep drafts of the precious liquid before being pushed forward by the horde behind. As the craving for water subsided, the juveniles started to play, dunking each other; the adults retreated to chuck hot sand over their backs. It had been years since I had been treated to such a social display by elephants on the savannas of central Africa. The elephants then filed up the opposite bank to continue their relentless search for dry season forage. Four minutes later, they vanished. The only movement

TWO LION CUBS IN ZAKOUMA WERE ORPHANED AFTER THEIR MOTHER LIKELY DRANK FROM A POISONED WATER HOLE.

came from a lone sandpiper scurrying along the bank and the red-throated bee-eaters nabbing insects above the constant churn of fish.

APRIL 11 Luis received a report of a column of 80 Chadian military vehicles moving south toward Am Timan, 25 miles east of the park. They had been sent to intercept rebels moving north toward the capital, N'Djamena. Marc Wall, the United States Ambassador to Chad, happened to be visiting the park, so I asked him about the rebels. He said they were targeting the regime of President Idriss Déby and were rumored to be financed by the Sudanese government. The region around Zakouma has always been in the cross fire of opposing interests—be it the U.S. versus Muammar Qaddafi, the Axis powers versus the Allies, or the sultans from Ouaddaï or Darfur versus the tribes of the south.

After dark, I joined Nick on the bridge. As we talked, four figures with AK-47s emerged from the blackness. They threw their guns to their shoulders and spoke to us in Arabic. To our relief, they were Chadian army regulars. They said their vehicle had broken down and they were seriously thirsty, so we took them to the tourist camp for water. There, an agitated Pierre told us that poachers had poisoned a roadside pool near the Machtour water hole. Nine civets, a lioness, two hyenas, five raptors, and hundreds of doves had died from drinking the water. Nathalie Vanherle, a lion researcher working in Zakouma, was also worried. The lioness she was monitoring had not come to feed

TO AFFIX A RADIOTRACKING COLLAR, A TEAM FROM ZAKOUMA SURROUNDS AN ELEPHANT NAMED ANNIE, ON HER SIDE AFTER BEING SEDATED BY A DART, AND HER BABY.

her cubs that evening, and her den was close to the contaminated water hole.

We returned to the bridge, somewhat nervously because of the rebel activity, but the elephants had not been informed. They showed up around 8:15. In the moonlight, I could see the little guys getting shoved forward, while the adults lined the banks, frantic for a drink.

APRIL 12 Nathalie came on the radio this morning. She had spotted a baby elephant killed by lions near the den on the Machtour. We found the carcass later that afternoon; it was a three-year-old female, still tuskless, whose mother may have been killed by poachers. The lower part of one of her back legs and her neck had been eaten, and a plate of skin was missing from her belly. A lion known to Nathalie as M03-03 was stretched out under the shade of a small *kharoub* tree, napping. He raised his head from his siesta, ambled over to the carcass, licked the belly, and approached the neck. He had a broken lower canine; you could see the exposed root. Slowly but surely, he cut into the flesh, yanking, grinding, licking, pushing ever deeper into the throat, finally pulling off a chunk of trachea and chewing contentedly with his back molars. After an hour, M03-03 headed off to find water.

Nathalie said that lions in the park commonly prey on young elephants. In the early 1980s, when elephant poaching by Arab horsemen from Darfur was out of control in the Central African Republic, I had seen many elephants orphaned by poaching become the preferred

Minutes later, a big female was on her knees, flapping her ears, a phosphorescent dart in her rump. She had a baby by her side. Henrik pushed the baby away as she charged, defending its mother. Soon, Henrik radioed: Collar 6043 was on.

prey of lions in Manovo–Gounda–Saint Floris National Park. I wondered if this was now happening in Zakouma.

We followed M03-03, hoping he wasn't heading for the poisoned water hole, until we reached a lone *ngato* tree, the grass tamped down below a halo of low-hanging branches. "This is where the cubs are," Nathalie said. Hearing our voices, the two cubs, whose mother we never found, emitted high-pitched growls and squeals. They wrestled and tumbled, not knowing that without the protection of their mother, they must now be counted as members of the living dead.

APRIL 13 News from the capital: hundreds of rebel soldiers killed or captured, and the rest of the column routed. We were on our way south to check on a breeding colony of bee-eaters when I saw a large helicopter to the southeast. It made straight for our truck. We could run, but we couldn't hide. It was a Russian-made Mi-17 with a missile launcher, the same type that had mistakenly fired the day before on a column of Chadian and American soldiers north of the park. The helicopter passed over us, continued to the Tinga River, and circled the trucks Luis had hidden to prevent them from becoming rebel spoils.

APRIL 15 We heard that the Mi-17 had fired nine missiles on a rebel column passing through the park about three miles from where the chopper had taken a bead on us.

APRIL 17 A pair of French military Mirage fighter jets running sorties toward Sudan (more than a thousand rebels were retreating there) buzzed the Tinga, spooking a herd of elephants I was watching at the pool. We went south again to check on an elephant we thought might have been wounded by poachers; she was limping hard, likely having taken a bullet in the leg. That evening, a low moon cast the ghostly reflection of a hundred elephants on the water at the Tinga pool. Zakouma was in the grip of the driest part of the year. This water hole was now elephant mecca.

APRIL 18 We found a fresh elephant carcass in the bed of the Salamat, which now held the only potable water in the park. Hundreds of pelicans lined up in rows, dipping their beak pouches into the water, pushing masses of fish to one end like a seine net. When the fish tried to escape, the pelicans quickly filled their gullets. Vultures appeared beyond the bank, hissing and pecking, claiming places at the dinner table with their serpentine necks. As whooshing wings departed, we got a clear view of the carcass. It was a bull. The elephant's face had been chopped off, his tusks gone. We camped with this fellow for three days, mourning him.

In the afternoon, we went upstream, where an elephant thoroughfare arrives from Rigueik. We saw elephants approaching the river downwind. We looped around. More elephants. We looped again. Yet more elephants—at least 500. Moms were leading their families up the river, the kids goofing around, whipping their trunks from side to side and splashing each other as they ran. In the excitement, a fish eagle dropped a flopping tilapia at my feet. A vervet monkey cackled from a branch over the high bank.

For an hour, I watched, marveling that these elephants, who spend their lives being hunted and killed by men, can find peace. How do they

Over the centuries, the people of the Zakouma area, like the elephants, have been decimated by raiders from the north. The Goula in the village of Bon survived by taking refuge in a mountain redoubt. Their spiritual ties to this place helped save the village in 1963, when the park was created.

endure the terror and despair? I have had a close bond with elephants since 1985, when I was doing research in the Dzanga clearing in the Central African Republic. I learned to speak their language—not literally, of course, but I feel as if I understand them. I know their habits, their personalities, their moods. I have laughed with elephants, and I have played their jousting game. Once, I almost died from tusk wounds inflicted by a frightened female on a beach in Gabon. After that, my African bush friends said, "Your blood is now part elephant blood."

I also thought about the humans living in this area, their lives ravaged over centuries by the slave trade. In Zakouma, the Goula people built their villages near the rocky crags in the west of the park, in an attempt to escape mounted Arab and Ouaddian raiders, who savaged, captured, and sold them as slaves, decimating their numbers. I have seen contemporary savagery on the same scale in civil war in central Africa, where friends of mine were hunted, raped, starved, and killed. Yet their kids still played; their women still laughed.

It is a sad fact that the vast majority of elephants in southeastern Chad don't die of old age. They die at the hand of man. Yet when I meet the Zakouma elephants, all I see is joy. No rage or thirst for revenge—just a desire to protect their young.

APRIL 21 I flew Luis to Am Timan so he could debrief Ahmat Hassan Djimet, governor of the Salamat region, about the passage of the rebels through Zakouma. Luis and the governor collaborate to preserve the park and maintain law and order in the region. Ahmat congratulated Luis for handling the rebel incursion so well —calming fears in the villages and communicating effectively with the military and with him. He was unhappy to hear that some of the park's weapons and radios had been stolen, but Luis suggested that this was a small price to pay for no animal or human casualties. The governor said he would speak to President Déby about getting more arms and ammunition for Zakouma.

APRIL 24 We tagged along with Luis on a public relations pilgrimage to see Aboul Habib, the grand marabout of the Ouled Rachid Arabs—nomads who, in the dry season, base themselves with their cattle at Andouma, a vital water hole just north of the park. Luis wanted a face-to-face discussion with the man who had great influence over those who felt inclined to graze their livestock and hunt elephants, giraffes, and buffalo in the national park. The scene evoked medieval Arabia: hundreds of grass huts, organized by clan, occupied an expanse of short, green grass. A cloud of smoke hung over the clearing. Boys chased herds of goats; women collected water in clay pots in the shallows. Dogs barked. We passed a group of men with camels who looked as if they might have come from ancient Jerusalem. The grand marabout's grass palace was filled with men in robes thumbing prayer beads. They were tall, black, with fine features, and they greeted us with long salutations in Arabic.

Luis sat in front of Aboul Habib, crowded by 30 clan members. The grand marabout wasted no time. He said that he knew that the plan was for Andouma to be annexed and incorporated into the park. Looking Luis in the eye with a paternal stare, he said, "If this happens, there will be death among men." Luis assured him repeatedly that Andouma would never be incorporated into Zakouma. But Aboul Habib had the example of history as evidence that Europeans do not always tell the truth. For the first 25 years of his life, Chad had been a French colony, won through warfare, assassinations, land grabs, and lies. Before the colonial era, his people had used the entire region as a dry season watering ground. Who could blame him for denying us his friendship and his tea? Having satisfied—albeit uncomfortably—our objective to maintain contact and peace with the Ouled Rachid, we joined Aboul Habib in prayer, then left.

APRIL 30 Back at the Salamat, the sky was a curtain of gray. Later that night, I was awakened by a thunderclap, followed by a rush of wind. Lightning creased the sky. As I emerged from my tent, a drop of water landed on my bare chest.

Ndjongo pulled hard, and with a loud, painful crack, the tusk broke free from tons of flesh and bone.

More drops and swirling wind. The elephants responded with trumpeting. Large drops dimpled the pond's surface. Then rain, real rain, poured down. A life-giving torrent flowed on the land, erasing the months of drought.

MAY 1 Oven-like heat yielded to temperate coolness. Gusts blew in from the south. Yesterday, there had been thousands of marabou storks and pelicans along the Salamat. Now, there was none. The antelope and buffalo and warthogs and herons—and seemingly all other animal life—had vanished. The rain had robbed the Salamat of its role as the sole source of sustenance.

MAY 9 I took off south for a solo flight to look for elephants along the lower Salamat. None. I turned west, following a vein of newly watered lands, with fresh green grass as far as I could see. Near the western border of the park, I spotted a solid gray mass. Making a wide turn, I saw a single matriarch leading an immense herd of 800 elephants southward. Other females flanked her in a perfect pyramid, leading their families single file. Why such an assembly? Maybe because there is safety in numbers, or because elephants love to socialize. Or perhaps it has to do with history. Elephant families are matriarchal. Grandmothers, mothers, and daughters with their children form the family unit. Males are pushed out before puberty. In their annual forays out of the park, the old matriarchs have survived decades of contact with humans. Surely then, these females, possessed of deep wisdom, are best able to navigate the other elephants through safe corridors to food sources outside Zakouma National Park.

MAY 10 Nick, aloft in the park's ultralight with Luis, spotted the big herd outside the southern border. Luis immediately dispatched the guards from Ibir and Kiéké, Zakouma's southern outposts, to look for poachers. The fliers also saw another elephant carcass in the Tinga wash, and I went there on foot to take a look. It was a female. Blood had drained from her temple into a pool fringed by maggots. I guessed she had been shot, then had bolted and died of her wounds. Even if her killer had succeeded in taking her tusks, the ivory would, at most, have paid for a few sacks of millet and a bit of sugar and tea. All the poachers I have ever seen, even those who have killed hundreds of elephants, are still poor, often—by the looks in their eyes—at the expense of their souls.

MAY 20 The elephant collaring team—Dolmia, Bertrand Chardonnet, and Henrik Rasmussen—arrived in Tinga. Our plan was to collar two females at the north end of the park to track their annual migration. We assumed that because many nomads were also moving through this area as the wet season set in, the northern elephants would be the most vulnerable to poaching.

MAY 23 We were in the air by 5 a.m. to provide aerial support for the collaring operation. About 700 elephants, in three subgroups, were concentrated in the northeast corner of the park. Bertrand, Henrik, Dolmia, and a group of guards went in on foot. We would keep in touch by radio, steering them to the elephants from our bird's-eye vantage. I directed them to one subgroup. Those elephants, Henrik reported, were all males. I guided them to a second group with females. Minutes later, a big female was on her knees, flapping her ears, a phosphorescent dart in her rump. She had a baby by her side. Henrik pushed the baby away as it charged, defending its mother. Soon, Henrik radioed: Collar 6043 was on. We named the elephant Annie. Rocking back and forth, Annie eventually hoisted herself upon all fours and stood still, composing herself. There was no sign of the baby. Then she began walking south. Meanwhile, the rest of

Water holes are in short supply at the end of the dry season, when as many as 500 elephants can converge on this pool near Tinga. By June, torrential rains engulf the park, and the herds leave in search of better food. At Zakouma, sanctuary comes and goes with the seasons.

the elephants had fled in two massive herds, dust billowing in their wake. During the next hour, Annie found her way directly to the first herd, then made a beeline for the second. Her baby still hadn't joined her.

That evening, we flew to Zakouma's southern boundary to see three elephant carcasses reported by the monitoring crew. Circling over the black stains of rotting bodies, we counted not three, but sixteen elephants. All their tusks were gone, chopped from their faces. We surmised that the southern herd had been attacked just after leaving the park.

MAY 24 In the morning, we resumed collaring in the northeast. Bertrand reported that the team had darted a small female, and we quickly located her from the air. She was down, ears flapping. Another, larger female stood guard at her side. I guided the team in. Soon, the collar was on, and the antidote to the tranquilizer administered. The elephant struggled to get up, then collapsed. Bertrand gave her a second dose of antidote. Minutes passed. Again and again, she raised herself up on her front legs, only to collapse with each attempt. Afraid to look, I flew off. Fifteen minutes later, she was still trying desperately to get up. Bertrand thought others in the herd might have trampled her as they fled, or that her female guardian had sat on her in an effort to get her moving. An hour later, no change. Pounding the dashboard, I knew I was to blame for her suffering—I had instigated this exercise. I flew back to headquarters to assist the team's effort to get water to the scene. On the ground with the elephant, we worked frantically, bucketing 250 gallons of cool water over her back, willing her to recover. It was futile. As the hours wore on, she became more and more exhausted, until she could scarcely hold up her head. We decided to anesthetize her again, remove the collar, and let her rest. Using ropes attached to the truck, we gently flipped her from right side to left. That's when we saw her broken pelvis. Any remaining hope evaporated. The order was given. As I walked away, devastated, a gunshot rang through the trees. Having come here as protectors, we, too, were now messengers of death.

I saw Souleyman later. On foot, he and a team of guards had surveyed the massacre site south of the park. He counted 20 carcasses in all, including a fetus, so we had missed a few in our aerial estimate. All the tusks had been removed, and the meat butchered by villagers. Shell casings revealed that the weapons had been AK-47 and M14 automatic rifles. From the position of the shells, there must have been at least three shooters. Souleyman blames the intensified poaching on the chaos in Darfur and the Central African Republic. "You can buy guns and ammunition in those places as easily as a camel," he said. Considering that a force of 88 armed guards is needed to keep the elephants inside Zakouma alive, these mass killings prove the potential for carnage outside the park, where the only protection comes from the elephants' own evasive abilities and the will of God.

MAY 31 Annie's collar had been on for ten days. I pulled out my computer, hooked up the satellite phone, and downloaded her latest location. What was going on? She had traveled more than 50 miles north of the park in just a couple of days. We took off to find her and, after flying over villages and millet fields for 25 minutes, reached a dense, viny thicket occupied by more than a hundred elephants. I couldn't believe they had gone so far so fast. We circled, and there, among one small group, was our collared lady, eating away happily, her baby at her side.

JUNE 15 I had to leave Zakouma for the United States, but I worried that our work wasn't finished. A wet season survey was needed to assess the elephant situation outside the park.

AUGUST 1 Invited by the Chadian government, I returned and teamed up with some of the Zakouma guards to search systematically for elephants and signs of poaching. First we surveyed inside the park again and, aside from the carcasses of three males, found no serious poaching activity. Then we flew a grid of transects outside

The signal from Annie showed her streaking south for three hours. After that, silence—no more signals.

the park to the north and south in areas Dolmia had identified as the wet season range. Over the days, we came upon evidence of rampant poaching: five sites where a hundred elephants had been massacred since May, their trunks and tusks hacked off. I saw poachers fleeing, and one man fired on the plane. Seeing the inert, dismembered bodies of elephants is every bit as disturbing to me as seeing the bodies of humans killed in war.

We now also have confirmation that as the rains progress and the plains outside the park turn green, elephants cross the boundary of protection in massive herds led by a single matriarch. Using her prodigious knowledge of the vegetation and landscape outside Zakouma—every trail, every creek crossing, every village and road—this wise old elephant uses routes that, for the most part, avoid all hazards. In daylight, when approaching a road that must be crossed, she will stop miles before reaching it. As soon as darkness comes, she starts the herd moving again, hurrying her dependents to safety.

AUGUST 15 The signal from Annie showed her streaking south for three hours. Then I received 14 readings from the same point. After that, silence—no more signals.

SEPTEMBER 28 Back in Zakouma and desperate to find Annie, I flew with guards from Am Timan to the point of her last transmission. At an acacia thicket, I passed just east of the point. There she lay—or rather, there lay the bones and fragments of her skin. With her were eight other elephants, all dead. As of this writing, Nicolas, Souleyman, and the other guards are collaborating with the Chadian military and gendarmes, scouting the territory outside the park in unrelenting pursuit of the poachers. Four elephant killers have been apprehended and jailed, including the man who fired on my plane.

What comes next for Zakouma? The situation in southeastern Chad is eerily reminiscent of the Central African Republic during the 1980s. We were in an all-out war against hundreds of armed men from Sudan, rampaging on horses and camels—the kind of men now known as janjaweed. Despite our efforts, we watched the black rhino driven to extinction over a large area and elephants reduced to 5 percent of their original populations.

There is a direct connection between depletion of natural resources, including wildlife, and human conflict. The sanctuary of Zakouma is not only a critical last stand for elephants in central Africa but also a force for peace and stability in the region. But if poaching outside Zakouma by villagers living on its periphery, or by nomadic herders, is to be stopped, management must be extended throughout the entire range of the elephants. A wider peace for elephants—and humans. □

NOTE TO READERS

Because its staff has stood firm in the face of adversity, Zakouma remains the best protected park in central Africa. But the fight to save Zakouma's elephants is urgent. The Chadian authorities have pledged to safeguard the herds when they leave the park during the wet season. Information networks must be strengthened, and collaboration with Chad's military reinforced. In addition, an airplane is needed for daily surveillance. *Turn to page 154 to find out how you can help.*

Elephant Walk Follow the elephants of Zakouma National Park, and the poachers who hunt them, in a multimedia presentation at **ngm.com/0703**.

Lions often feast on young elephants in Zakouma in the dry season, when herds become concentrated around water holes. Orphans of adult elephants killed by poachers are especially vulnerable.

PANTHERA

ZAKOUMA EYE

TO EYE

TEXT AND PHOTOGRAPHS BY MICHAEL NICHOLS

NATIONAL GEOGRAPHIC PHOTOGRAPHER

Mike Fay's tales of giant groups of migrating elephants lured me to Chad, but soon I had a separate venture to pursue. In the dry season, an abundance of animals congregates in Zakouma, but you can't get close. So I decided to let them make self-portraits. I set up photographic traps—cameras equipped with an infrared beam that, when broken, triggers the shutter. The clicking sound caught the attention of a baboon (below). Fascinated by his own reflection in the lens, he took 52 pictures of himself. Other young males couldn't resist fooling with the cameras, which my assistant, Nathan Williamson, would then have to reset. A long neck and legs and acute ears help serval cats hunt in tall grass. These predators trap small mammals, but here the trap was mine. I loved using this technology because, at times, it produced pure surprise—like a shot of a crocodile's tail (overleaf) that is part Zakouma, part Jurassic Park.

PAPIO ANUBIS; CROCODYLUS NILOTICUS (OVERLEAF); *LEPTAILURUS SERVAL* (RIGHT)

MEROPS NUBICUS

GIRAFFA CAMELOPARDALIS

Surging from holes they had dug in a dried-up, sandy riverbed, a breeding colony of carmine bee-eaters (left) gathers at sunset and embarks on a mysterious, swirling flight; by nightfall, the birds are back in their holes. During the day, bee-eaters catch honeybees and other insects, sometimes displaying them outside their holes to attract mates. On rare occasions, Arab horsemen sneak into the park and try to kill giraffes for their tails, coveted as traditional wedding gifts; inside Zakouma, the men face armed guards willing to fight to the death. Over time, the giraffe population has risen to about 600, the largest concentration in central Africa. Before the rainy season begins, any pool of water in the park becomes a magnet for animals. During a stakeout at one water hole, I caught a glimpse of a male waterbuck, one of thirteen antelope species in Zakouma.

KOBUS ELLIPSIPRYMNUS DEFASSA

LOXODONTA AFRICANA

Distant gunfire startled this bull and caused it to bolt. Zakouma's future as a wildlife refuge depends on the continuing dedication of its guards—and support from the outside world.

A superheated jet of plasma, the last gasp of a dying star, fires into space at nearly the speed of light in a computer-generated image. In recent years scientists have begun to understand how stars die—and produce the universe's most dazzling explosions.

WEIQUN ZHANG, STANFORD UNIVERSITY, AND STAN WOOSLEY, UNIVERSITY OF CALIFORNIA AT SANTA CRUZ. SUPERCOMPUTING: LAWRENCE BERKELEY NATIONAL LABORATORY (LBNL) AND NASA AMES RESEARCH CENTER

BANG

THE CATACLYSMIC DEATH OF STARS


N G

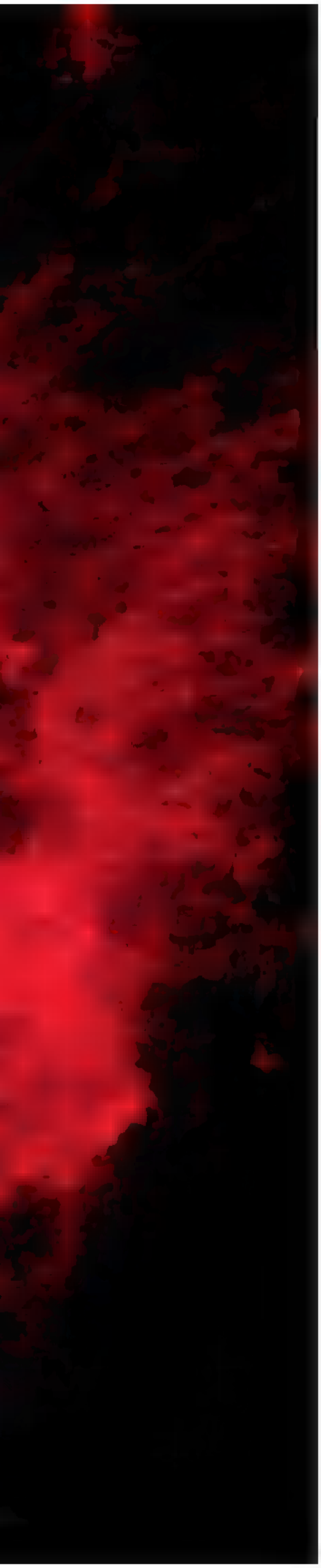
ONCE A SECOND SOMEWHERE IN THE UNIVERSE A STAR EXPLODES WITH THE BRILLIANCE OF AN ENTIRE GALAXY

SUPERNOVAS

Like bonfires in the night, type 1a explosions shine with roughly equal brightness and can serve as benchmarks of cosmic distance. In images of distant galaxies, they appear as bluish dots near the center of each frame.

BEN DILDAY, UNIVERSITY OF CHICAGO; ASTROPHYSICAL RESEARCH CONSORTIUM; AND SLOAN DIGITAL SKY SURVEY COLLABORATION

JEFF HESTER, ARIZONA STATE UNIVERSITY; NASA



BY RON COWEN

Ever since he was a teenager, Stan Woosley has had a love for chemical elements and a fondness for blowing things up. Growing up in the late 1950s in Texas, "I did everything you could do with potassium nitrate, perchlorate, and permanganate, mixed with a lot of other things," he says. "If you mixed potassium nitrate with sulfur and charcoal, you got gunpowder. If you mixed it with sugar, you got a lot of smoke and a nice pink fire." He tested his explosive concoctions on a Fort Worth golf course: "I screwed the jar down tight and ran like hell."

Woosley, now an astronomer at the University of California at Santa Cruz, has graduated to bigger explosions—much bigger. Woosley studies some of the most powerful explosions since the birth of the universe: supernovas, the violent deaths of stars.

The universe twinkles with these cataclysms. They happen every second or so, usually in some unimaginably remote galaxy, blazing as bright as hundreds of billions of stars and creating a fireball that expands and cools for months.

We're lucky that they rarely strike close to home. The last supernova in our own galaxy exploded in 1604, rivaling Jupiter's brightness in the night sky and deeply impressing Johannes Kepler, the pioneering astronomer. A nearby supernova—within a few light-years—would bathe the Earth in lethal radiation.

Yet the legacy of supernovas is as close as our own bodies. The carbon in our cells, the oxygen in the air,

A SUPERNOVA IN WAITING

Eta Carinae, a star a hundred times more massive than the sun, seethes between enormous clouds of gas and dust in this composite image. Some 8,000 light-years away, the star is on the verge of going supernova, but astronomers can't predict when.

the silicon in rocks and computer chips, the iron in our blood and our machines—just about every atom heavier than hydrogen and helium—was forged inside ancient stars and strewn across the universe when they exploded billions of years ago. Eager to understand our origins and, in some cases, simply wild about things that go bang, astronomers have been struggling for decades to understand why stars that shine peacefully for millions of years suddenly blow up.

Lately they've had two big breaks. One is a revelation about potent blasts of high-energy gamma rays that come from distant points in the heavens. For decades astronomers have puzzled over their origins, but space probes recently clinched the answer, which Woosley proposed more than a decade ago: Many gamma-ray bursts are the early warning signals from supernovas, emitted minutes before the explosion.

The link offers a glimpse of events leading up to the actual explosion—another mystery. There, too, researchers have made headway. Looking not at the heavens but at computer models of supernovas, some think they have figured out what may trigger the final cataclysm. The missing element may be unimaginably powerful reverberations—the sound of a star singing its own swan song.

For astronomers, there's usually no rush to study something before it vanishes. "The universe usually evolves as slowly as watching paint dry," says one. But these days, hundreds of astronomers keep cell phones and beepers close by so they can rush to work like doctors on call. They're waiting for word from a spacecraft called Swift.

Swift, launched in 2004, scans the skies for gamma rays. When it detects a burst, it swivels its telescopes toward the source to get a good fix and detect the afterglow—the lingering point of light that marks the spot where a burst originated. It also sends an alert to earthbound astronomers, who can take a closer look with bigger telescopes.

Early on February 18, 2006, Swift recorded an outpouring of gamma rays from somewhere toward the constellation Aries. Within three minutes, the satellite had determined the position of the burst and broadcast an alert. Two days later, astronomers at a telescope in Arizona reported that the burst came from a small, nearby galaxy, only a fraction as far away as usual.

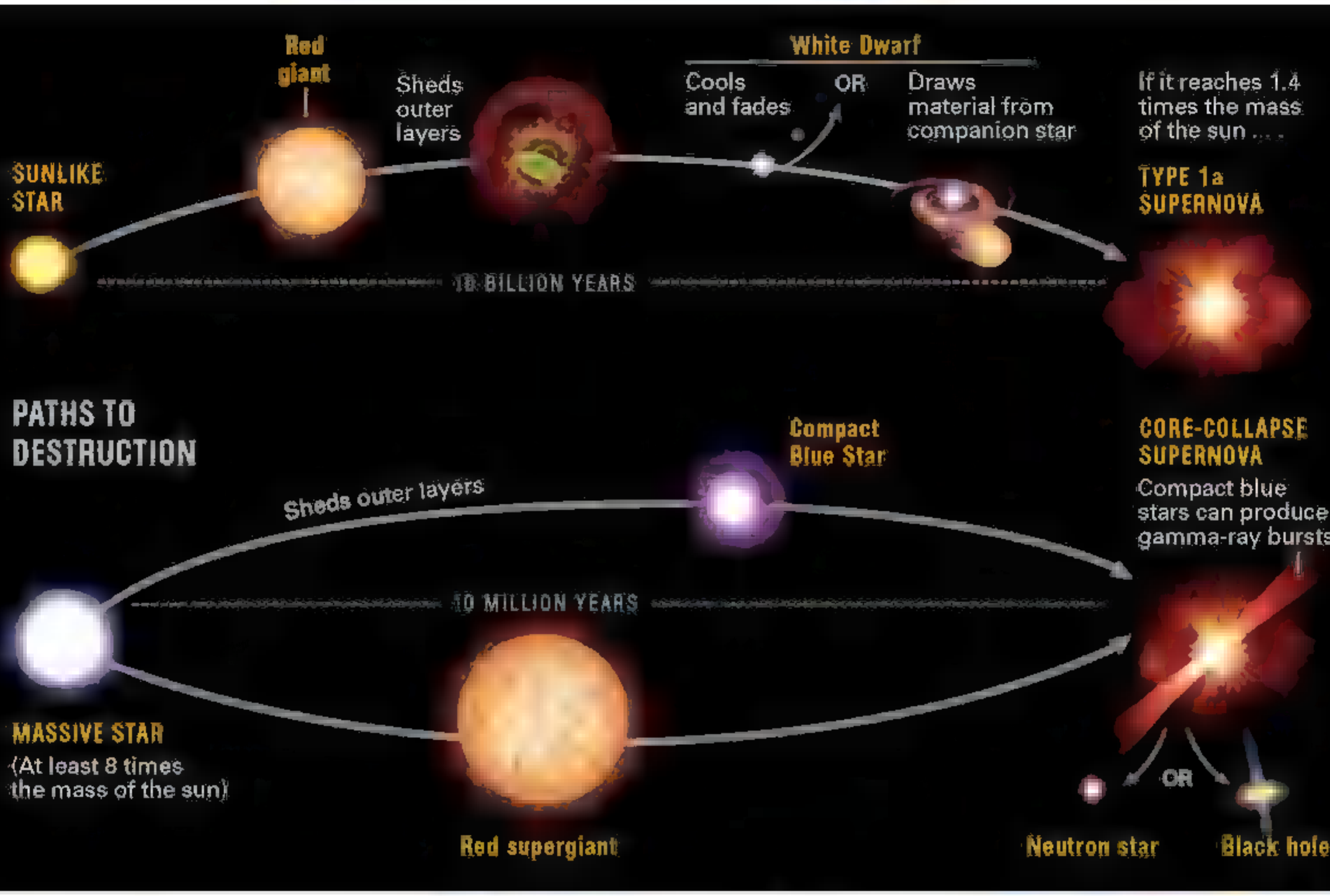
Astronomers had already traced a connection between bursts and supernovas. But this burst was so close, and Swift had spotted it so quickly, that scientists hoped it would help confirm what they suspected: A gamma-ray burst is an exploding star's opening act.

After an unusually long flood of gamma rays and x-rays, lasting more than half an hour rather than the typical few seconds, the February 18 burst gave way to visible and infrared light. Within three days this afterglow was fading away—and then the supernova grabbed the spotlight.

Astronomers at the Very Large Telescope in northern Chile were watching the afterglow dwindle when they noticed a brightening. The star had exploded just a minute or so after the burst, but most of its energy was invisible ultraviolet and x-ray radiation. Its visible light had brightened more slowly, and now it was finally outshining the afterglow. For the first time, astronomers had seen a gamma-ray burst evolve into a supernova from the very beginning.

Eighteen days after the supernova flared into view, astronomers were still watching. Atop Palomar Mountain in southern California, the observatory dome's twin shutters slid open under patchy clouds, letting a sliver of night sky fall onto the caged mirror of the 200-inch Hale Telescope. Caltech astronomer Avishay Gal-Yam had two hours before the supernova would dip too low in the sky for the telescope to see it.

Still more luminous than a billion suns, the supernova outshone the combined light from all the stars in its home galaxy, glowing white-hot from the radioactive decay of unstable nickel atoms forged in the explosion. Gal-Yam pointed to a computer screen showing a squiggly line—the glow broken down into its component colors, or wavelengths. Each dip in the line represented a wavelength of light absorbed by a different element—silicon, cobalt, calcium, iron—in the debris of the star.



LIFE AND DEATH OF STARS

Small sunlike stars age slowly into dwarfs that explode only if they steal fuel from a companion star. Massive stars live fast and ultimately explode—sometimes unleashing a gamma-ray burst—when their cores collapse. All that remains is a dense neutron star or black hole.

Destruction and creation were conjoined on the screen. The elements revealed there, like those from countless earlier supernovas, will eventually find their way into new stars and perhaps new planets, Gal-Yam said. He added: "I'm just really happy to be observing this."

The star had begun its race to destruction long before that night on Palomar, when it began to lose a lifelong fight against gravity. Gravity is responsible for setting newborn stars aflame, by squeezing atoms of hydrogen in the star's core so tightly that they fuse to make helium. The fusion generates light and heat and also exerts pressure that allows the core to withstand the enormous weight of the star's outer layers.

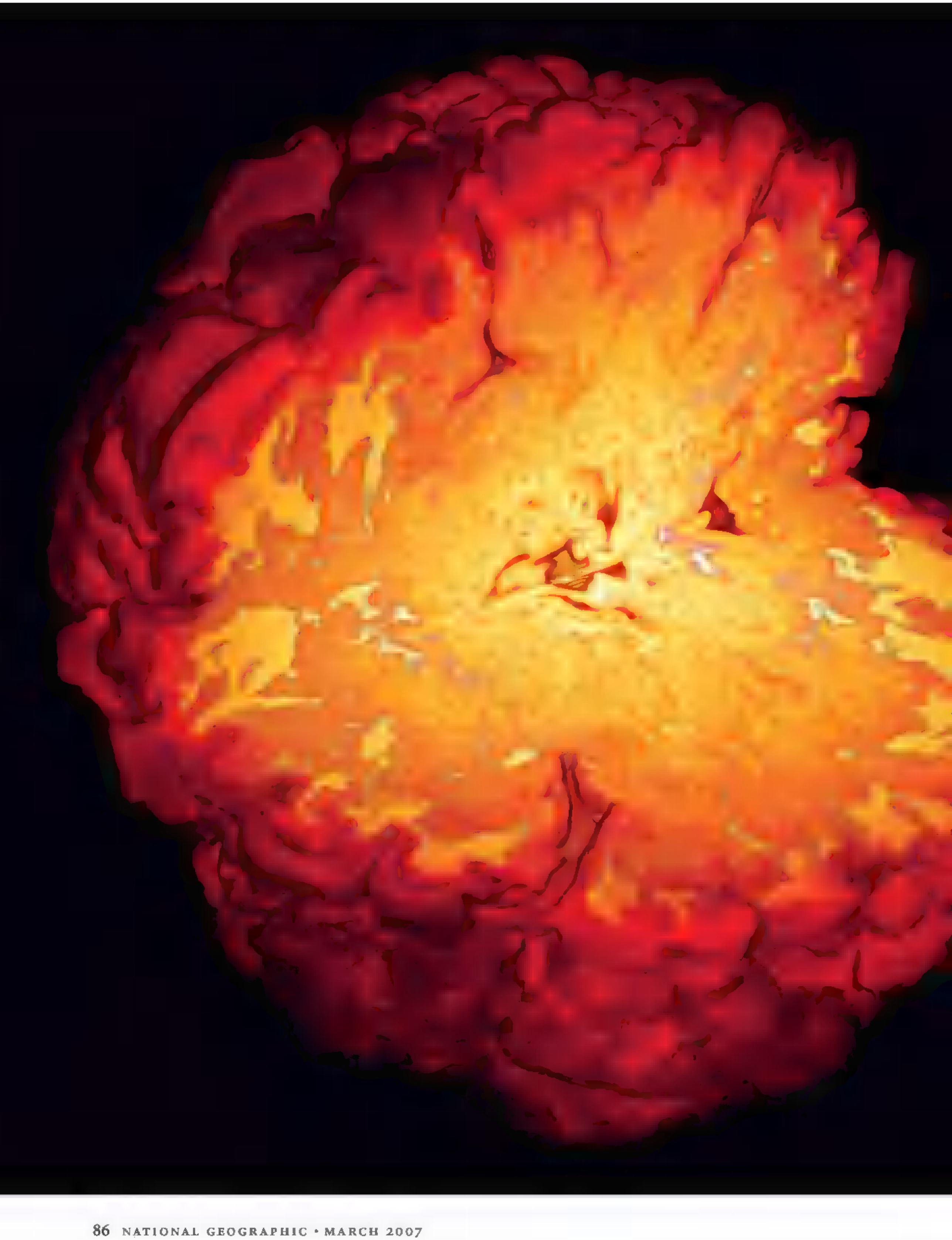
But when the core consumes all of its hydrogen, gravity compresses it. The temperature of the shrinking core rises to about a hundred million degrees, hot enough for helium nuclei to fuse and make carbon. The new surge of energy keeps the core from collapsing much further.

For an isolated star no heavier than the sun, there is little more to the story. The star burns all of its helium and shrivels. It turns into a white dwarf about the size of Earth, aging and cooling indefinitely—unless it lies close enough to another star to steal its neighbor's outer layers of hydrogen. If enough material falls onto the white dwarf, the siphoned fuel ignites a thermonuclear explosion. As the detonation spreads, the entire star blows up in what is known as a type Ia supernova—a giant nuclear bomb.

The supernova blossoming over Palomar was a different kind: not a thermonuclear blast but a star's catastrophic collapse. This is the only kind of supernova that can unleash a gamma-ray burst, and it is the inevitable fate of a star more than eight times as massive as the sun.

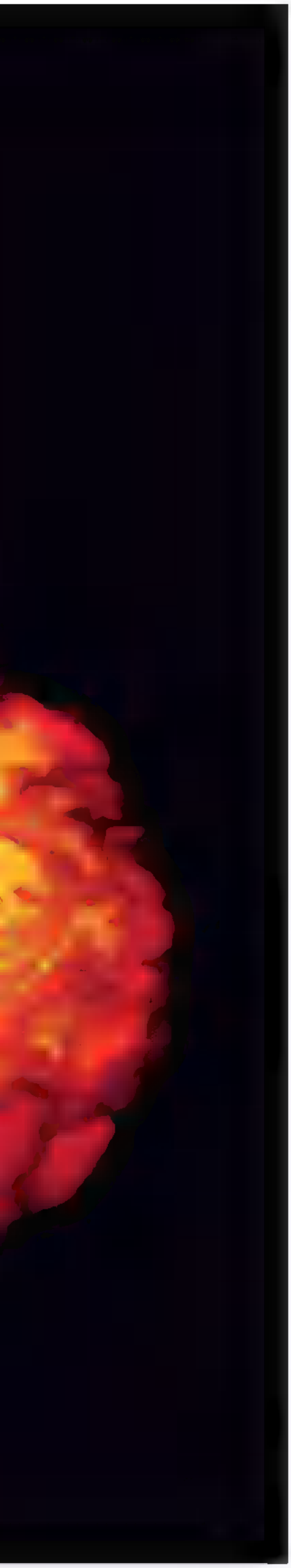
Such heavyweight stars always lose their battle with gravity. With the crushing weight of the star's outer layers bearing down on its core, the fusion reactions *(Continued on page 90)*

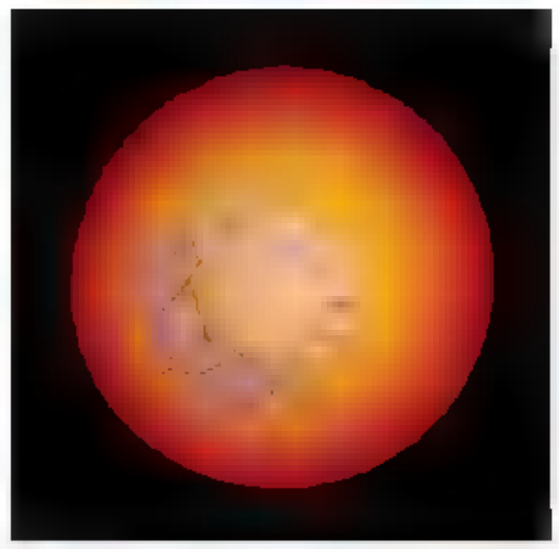
ART: DON DIXON. SOURCE: STAN WOOSLEY, UNIVERSITY OF CALIFORNIA AT SANTA CRUZ



TYPE 1a SUPERNOVA

LAST MOMENTS OF A DWARF STAR





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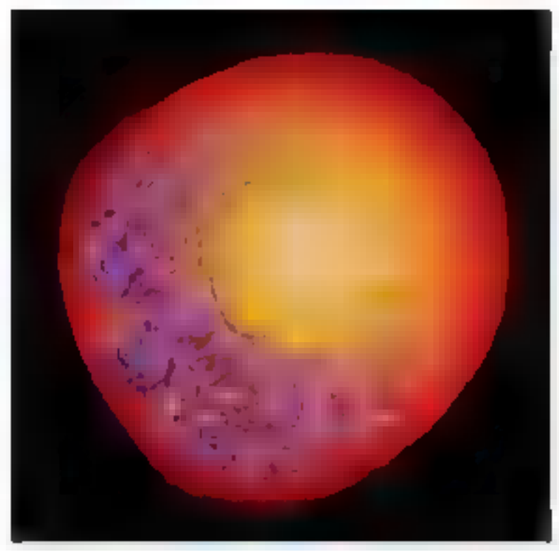

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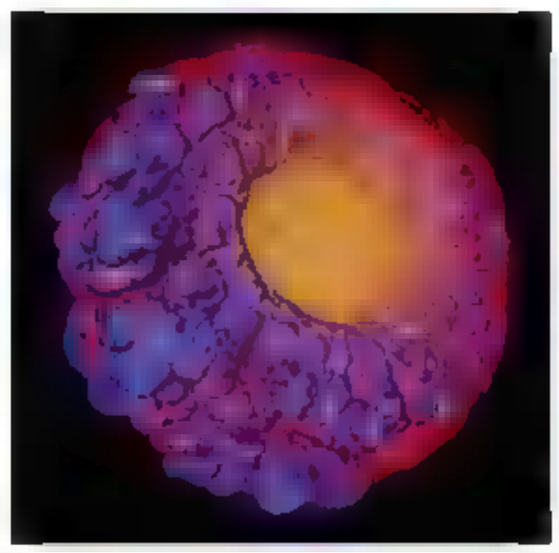

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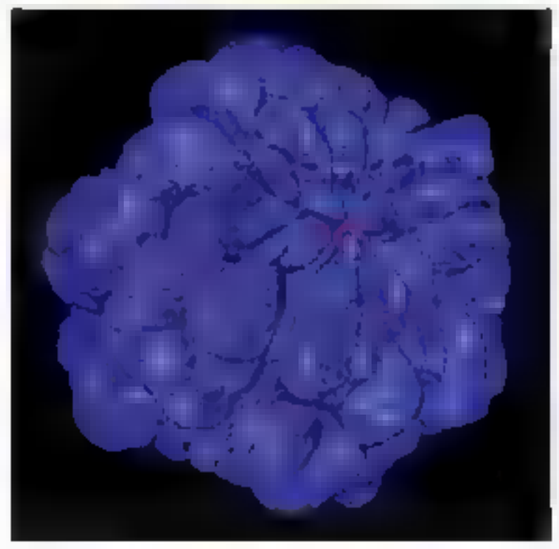


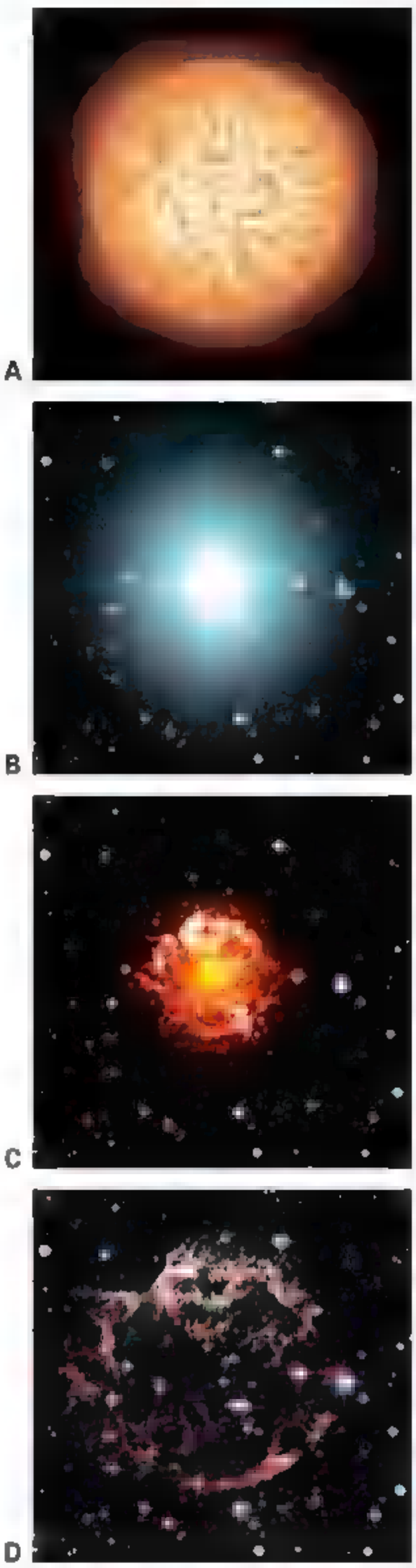
D

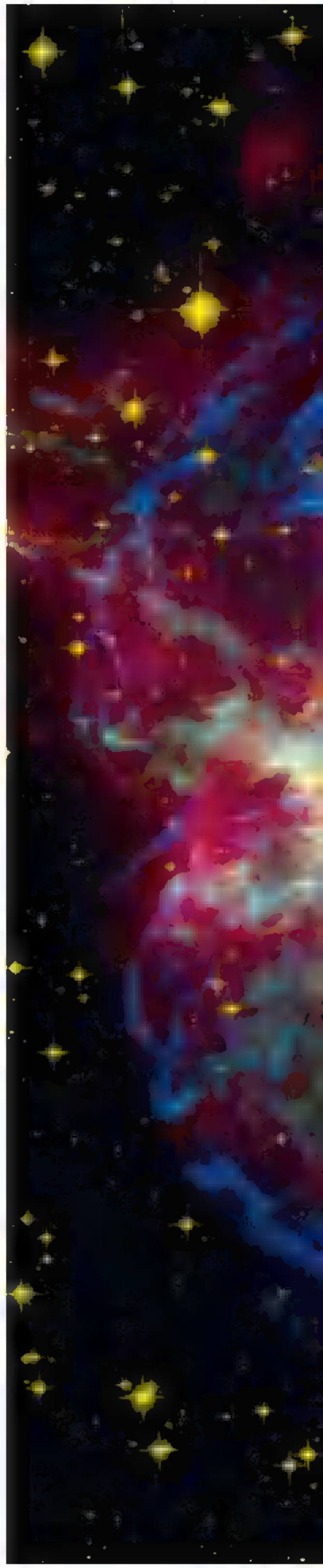
One of the universe's biggest bangs begins in a white dwarf star that has sucked extra material from another star nearby. This computer model shows how immense pressure and heat near the center ignite a nuclear firestorm (A). Burning carbon and oxygen, the flame (blue, B) billows outward (C and D). The star is destroyed, leaving a radioactive cloud (left) of nickel and other elements that glows as bright as a galaxy for weeks.

FRIEDRICH ROPKE, UNIVERSITY OF CALIFORNIA AT SANTA CRUZ AND MAX PLANCK INSTITUTE FOR ASTROPHYSICS, GERMANY. SUPERCOMPUTING: OAK RIDGE NATIONAL LABORATORY AND RZG, GERMANY

CORE-COLLAPSE SUPERNOVA

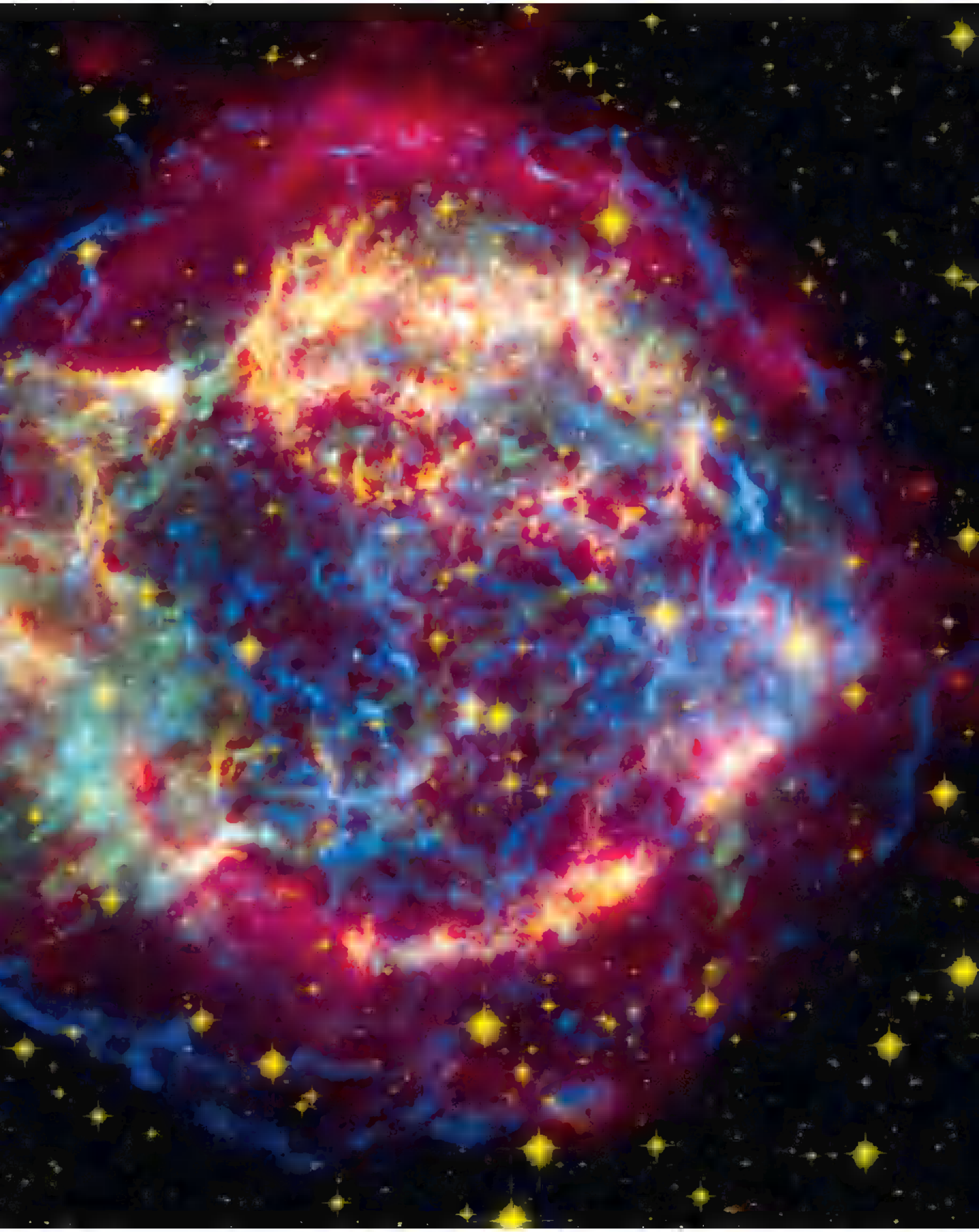
A MASSIVE STAR IMPLODES





A halo of gas called Cassiopeia A is a remnant of a star that blew up 325 years ago. Artists' impressions show what happened, starting with a massive star (A) that ran out of fuel and collapsed. The resulting explosion (B) blew off the outer layers (C), leaving the cloud seen in a telescope image (D). The blue dot near the center of the false-color composite (right) is the leftover core, a neutron star so dense that a pinch of it would outweigh an Egyptian pyramid.

(A) DON DIXON; (B, C) ROBERT A. FESEN, DARTMOUTH COLLEGE, AND JAMES LONG. NASA/ESA; (D) HARVEY RICHER, UNIVERSITY OF BRITISH COLUMBIA AND NASA/ESA
RIGHT: NASA/JPL/CALTECH/OLIVER KRAUSE, UNIVERSITY OF ARIZONA



(Continued from page 85) don't stop at carbon. The star continues to cook lighter nuclei into progressively heavier elements, but each nuclear reaction runs its course faster. The transformation from carbon to oxygen takes 600 years, from oxygen to silicon 6 months, from silicon to iron a day. Once the star's core turns to solid iron—a sphere no bigger than Earth that weighs as much as the sun—its fate is sealed. In less than a second, the star will explode.

Iron marks the end of the road because unlike lighter elements, iron atoms consume rather than create energy when they fuse. Fusion can no longer provide the energy to support the star's outer layers, and the core simply implodes. Usually the result is a neutron star, a stellar cinder so dense a teaspoon would weigh more than a billion tons. In the most massive stars the collapse leaves only a voracious pit called a black hole.

At this point, Woosley believes—before the collapse somehow turns into an explosion—some supernovas unleash a blast of gamma rays. Woosley's interest in these bursts goes back decades, when they were so mysterious that over a hundred more or less serious ideas about their cause were in play, from "starquakes" to the exhaust plumes of alien spacecraft. But his fascination deepened in the early 1990s, when a spacecraft called the Compton Gamma-Ray Observatory showed that gamma-ray bursts originate far beyond our galaxy. To appear as bright as they do, they had to be more energetic than anyone had imagined—far brighter than supernovas, Woosley's first love.

They also needed a source of energy far beyond what any ordinary star could provide. Perhaps the cataclysmic jolt of a collapsing star could somehow be harnessed to produce gamma rays. So Woosley set out to determine how a core-collapse supernova could generate a burst.

He and his collaborators, including Andrew MacFadyen of New York University, stage their explosions in computers. They start with a whopper of a star, about 40 times the mass of the sun, spinning so fast—several hundred miles a second at the equator—that it barely keeps from flying apart. Near the end of its life, unable to resist the pull of its own gravity, the core of the star collapses to make a black hole. But because the star has so much spin, some of the infalling material resists the tug of the newborn black hole. A swirling disk of material forms around the hole—a maelstrom deep within the doomed star.

"Rotation is the name of the game," says Woosley. Without spin, there would be no disk. And without a disk, there'd be no burst. Friction heats the disk, whipping around the black hole thousands of times a second, to 40 billion degrees, while new material keeps cascading in. Moments after the black hole forms, jets of superheated gas blowtorch outward.

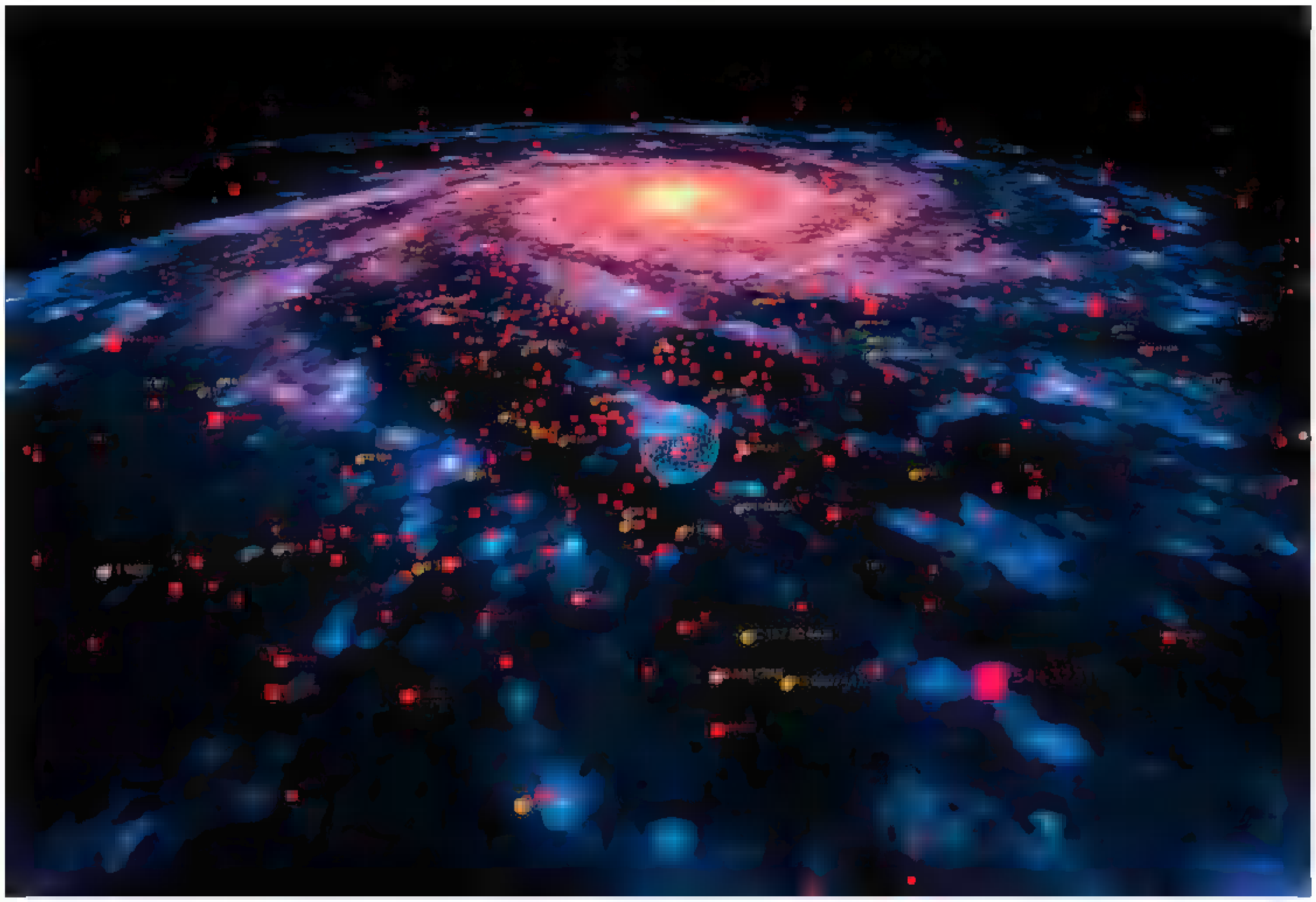
Each jet may draw its energy directly from the friction in the disk, or from the newborn black hole, via the magnetic fields that link it to its surroundings. Like the original star, the black hole spins frenetically, which could cause the fields to stretch, twist, and snap like rubber bands, dumping vast amounts of energy into the disk.

Either way, the jet shoots outward, reaching the surface of the star in a mere ten seconds. If the star has retained its original, puffy envelope of hydrogen gas, the jet stops dead and the gamma-ray burst may fizzle. But if the powerful winds that blow from some massive stars have stripped away the hydrogen earlier in the star's life, the jet escapes, arrowing into space at more than 99 percent of the speed of light.

Now comes the burst: High-speed collisions between blobs of material in each jet produce a cascade of speedy electrons. The electrons whirl around the jet's magnetic fields, flinging out gamma rays. Over many days, as the jet plows into the thin gas between the stars, it generates an afterglow at visible, infrared, and radio wavelengths.

The February 2006 burst was dimmer than most, perhaps because the star was not massive enough to form a black hole. Woosley suggests that the same sequence of events—an implosion, a spinning disk, jets—can still happen when the stellar collapse ends with the formation of a fast-spinning neutron star rather than a black hole.

Even after the jets have erupted, the star has not yet exploded. "The jet gets to the surface



PAST BLASTS

A history of violence surrounds Earth, within the sphere at center, in ■ map showing where stars in the Milky Way exploded hundreds or thousands of years ago. Even the closest lies hundreds of light-years away. Our sun won't join them; over billions of years it will just fade away.

CARTER EMMART, AMERICAN MUSEUM OF NATURAL HISTORY

of the star minutes beforehand," says Woosley. "The burst is a herald of the supernova."

It's not enough, however, to cause the explosion. "Just running a jet through a star won't make a very good supernova," says Woosley. "It will unbind some of the star, but most of it will fall back." To make a collapsing star explode, he says, "there needs to be something else."

In the stars that launch gamma-ray bursts, the spinning black hole and the disk may pump out enough energy to blow the star apart. But in most collapsing stars, the collapse ends when the Earth-size core crunches into a neutron star the size of a city, at a temperature of a hundred billion degrees. This is the point of maximum scrunch. The squeezed core rebounds like a squished sponge, launching a shock wave that races outward, ramming into the material that is still pouring down from the star's outer layers.

Astronomers once thought this shock would be enough to tear the star apart and generate the explosion, says Adam Burrows of the University of Arizona. Turns out it's not so simple.

Simulating a supernova gobbles enormous amounts of computer power, and even the largest supercomputers can't fully reproduce an exploding star in three dimensions. But over the years the models have improved, and the shock wave scenario has fallen apart.

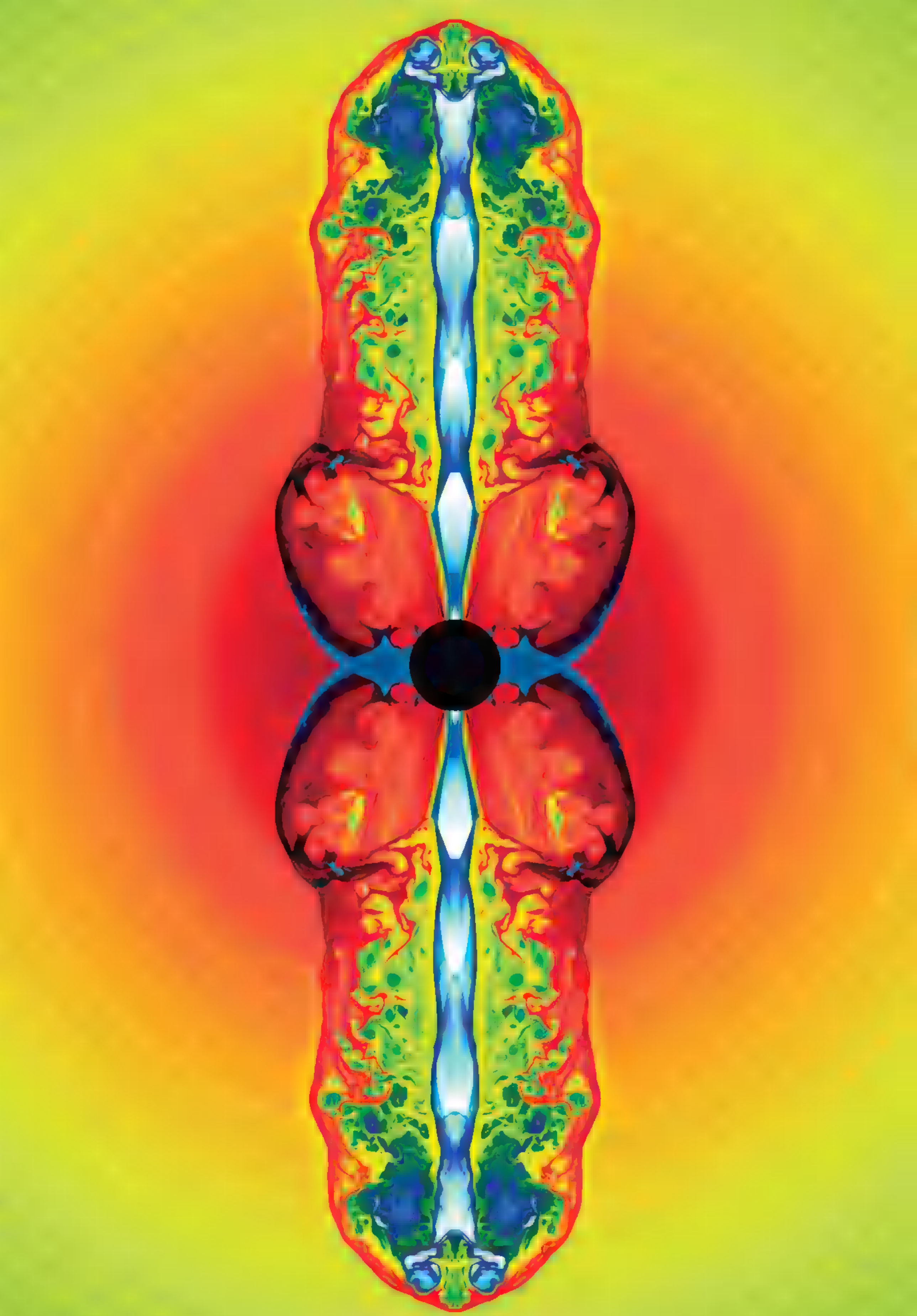
Researchers found that less than a thousandth of a second after the shock wave is generated, a flood of tiny, nearly massless particles called neutrinos escapes from the center of the star. The neutrinos, born in the collapsing core, drain energy from the shock wave. The shock stalls, and—at least in the computer—the supernova is a dud.

Now Burrows and his colleagues are working with a computer model powerful enough to simulate how the core shakes and churns during the collapse, and they've finally seen how a collapsing star could turn around and explode. The turbulent infalling gas starts shaking the core,

BIRTH OF A GAMMA-RAY BURST

Hundreds of computers crunching numbers in unison are required to model what happens inside ■ massive, fast-spinning star in its death throes. After the core collapses (above), plasma jets spew forth (blue), surrounded by four plumes of slower gases (orange). A few seconds later (facing page), the jets stream toward space, where they'll release ■ brilliant burst of gamma rays. Meanwhile, the plumes unfurl like fiery flower petals, driving the supernova. Such massive explosions blast elements like iron, carbon, and oxygen out into the universe. "The iron in our blood comes from supernovas," says astrophysicist Andrew MacFadyen. "There's ■ direct connection between stars and us."

ANDREW MACFADYEN, NEW YORK UNIVERSITY, AND WEIQUN ZHANG, STANFORD. SUPERCOMPUTING: LBNL AND NASA AMES



NO ESCAPE

In death, a supermassive star sometimes collapses into ■ black hole. This computer image shows how the immense gravity of the hole acts as a lens, distorting background starlight. Although black holes are invisible, astronomers have detected radiation from their surroundings—evidence of the dark fate awaiting some stars.

DENVER MUSEUM OF NATURE & SCIENCE. SIMULATION: ANDREW HAMILTON, JILA AND UNIVERSITY OF COLORADO. BACKGROUND: NATIONAL CENTER FOR SUPERCOMPUTING APPLICATIONS

causing it to pulsate. Raining down from the star's outer layers, the gas wraps around the core, dancing over its surface and penetrating its depths.

"The core is oscillating, and the stuff falling onto the core is exciting it," says Burrows. In about eight-tenths of a second, the oscillations are so intense they send out sound waves. The waves exert a pressure that expels material, reinforcing the shock wave created by the star's collapse. They also amplify the core's vibrations in a runaway reaction, says Burrows, "until the star finally explodes."

For someone brave enough to come within hearing distance, the waves would be audible, roughly the F note above middle C.

Burrows acknowledges that sound waves may not be the full story. But his model tends to produce a lopsided explosion, and stars do indeed explode asymmetrically, with more punch in some directions than others. That was true for supernova 1987A, recorded 20 years ago, the closest and brightest supernova since 1604. Astronomers also have found that some of the neutron stars left behind by supernovas zip along at 500 miles a second, as if the explosion had imparted an enormous kick in one direction.

Stronger evidence for the sound wave idea could come from two sprawling facilities, in Hanford, Washington, and Livingston, Louisiana, designed to detect gravitational waves—ripples in the fabric of space and time. Gravitational waves, predicted by Einstein's theory of general relativity but never directly observed, should be produced whenever immense masses shake and twist, as they do in the core of a supernova.

If sound waves really are at work inside a collapsing star, it should vibrate only at certain frequencies, generating matching gravitational waves. Burrows calculates that for a supernova in or near our galaxy, the existing detectors could pick up these signals—clues to a big, big noise.

Stars, it seems, really may go *kaboom*. Woosley, still in love with pyrotechnics, is delighted. "It's like God built the universe just for me." □

Life and Death in Deep Space Watch stars explode and give birth to black holes in a multimedia production at **ngm.com/0703.**

The Theme-Parking, Megachurching, Franchising, Exurbing, McMansioning of America

How Walt Disney Changed Everything

By T. D. Allman
Photographs by David Burnett

For 13-year-olds Paige Phillips, left, and Abbey Key, of Oxford, Alabama, Disney World is ■ once-in-a-childhood pilgrimage, ■ dream come true. Seventy million people a year visit Orlando theme parks.

Orlando is the new American metropolis.

Everything happening to America today is happening here, and it's far removed from the cookie-cutter suburbanization of life a generation ago. The Orlando region has become Exhibit A for the ascendant power of our cities' exurbs: blobby coalescences of look-alike, overnight, amoeba-like concentrations of population far from city centers. These huge, sprawling communities are where more and more Americans choose to be, the place where job growth is fastest, home building is briskest, and malls and megachurches are multiplying as newcomers keep on coming. Who are all these people? They're you, they're me, and increasingly, they are nothing like the blue-eyed "Dick and Jane" of mythical suburban America.

Orlando's explosion is visible in every shopping mall and traffic jam. You can also see it from outer space. When Earth satellites were first launched, Florida photographed at night looked like two *I*'s standing side by side: One long string of lights ran down the Atlantic side of the peninsula; another ran along the Gulf of Mexico side. In between was darkness. Today the two parallel *I*'s have become a lopsided *H*. Central Florida glows as though a phosphorescent creature from outer space has landed there and started reproducing. It gobbles up existing communities even as it transforms scrub and swamp into a characterless conurbation of congested freeways and parking lots. All of this is "Orlando," the brand name for this region of two million residents.

When people tell the story of Orlando's stunning transformation from swamp and sinkhole to 21st-century metropolis, they begin, inevitably, with the man and the mouse. The mouse is Mickey, the man Walt Disney. If it weren't for Disney, the local saying goes, the Orlando region would be called Ocala, a rival town up the road. Disney first flew over central Florida in an airplane chartered under an alias to keep his mission secret. It was the fateful day of November 22, 1963. The Kennedy assassination would mark America forever. So would the decision Walt Disney made that day to turn an inland Florida agricultural center into an epicenter of world tourism.

Orlando was the county seat of Orange County, but it wasn't citrus groves that prompted Disney's secret aerial reconnaissance. During his flyover, he focused on a wasteland southwest of Orlando where alligators outnumbered people. Porous limestone underlay the vegetal muck. What passed for dry land was speckled with shallow, brown-watered catchments, some the size of station wagons, others the size of suburbs. "That's it," Disney proclaimed, pointing down to the future site of what he dreamed of creating in this Florida wilderness: Epcot, America's Experimental Prototype Community of Tomorrow.

Over the next two years, with the collusion of Orlando's top leaders, Disney secretly acquired more than 25,000 acres. People were glad to sell dirt cheap. This sludgy terrain was useless for agriculture. It was far from Florida's beaches. It was hot and muggy most of the year, yet it got so cold during central Florida's brief winters that deep freezes periodically killed the citrus crop.

Who would want to vacation in such a place? Disney was certain most Americans would, once he worked his marketing magic on them. By the 1960s, all over America, suburbs were replacing

LIVING IN A SPRAWLING SUBURB VERSUS A COMPACT CITY

CAN ADD 6 POUNDS TO YOUR WEIGHT.

old neighborhoods. Malls were driving Main Street out of business. There was hardly a new ranch home or split-level that didn't have a TV antenna on the roof. Disney realized that in the coming decades shows like *The Mickey Mouse Club*, not climate and geology, would determine what the majority of Americans would consider a safe and enjoyable place to take a family vacation. That day, flying over central Florida, Disney decided that he, not reality, would define what constituted the Magic Kingdom in the minds and spending habits of millions of Americans in the years to come.

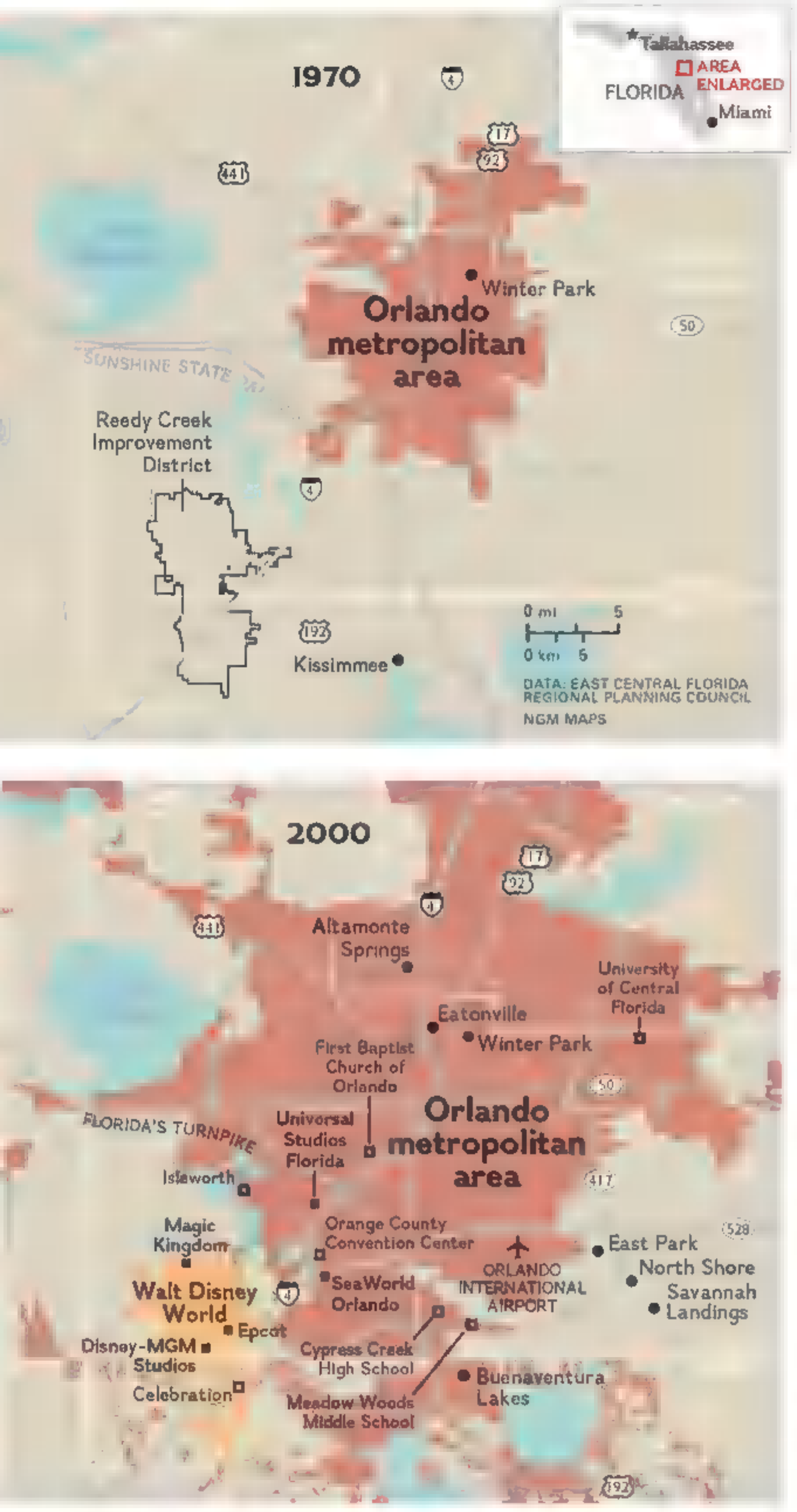
The interstate highway system, started by the Eisenhower Administration as part of the Cold War defense effort against communism, was already crisscrossing America. Disney chose Orlando because it was at the confluence of two of the most important of these new thoroughfares, what today are Interstate 4 and Florida's Turnpike. There was also a deeply personal reason he located Disney World there—the same one that still lures people to Orlando today. In Florida's boggy, buggy, empty midsection, Walt Disney perceived a second chance.

His original theme park—Disneyland, in southern California—covered fewer than 300 acres. It soon was ringed with the suburban blight that its success inevitably attracted—motels, strip malls, copycat amusement parks. Disney never forgave himself for not making Disneyland big enough, but in Florida he hoped to rectify that mistake. He set out to create an Adventureland where nothing was left to chance. Arriving visitors would not be permitted to choose their own parking spaces; smiling Disney characters would do that for them. In this new, bigger, better Magic Kingdom, water could not be the tannic brown common in central Florida. So Bay Lake was drained, the sludge removed, and clear water pumped into the resulting lagoon. Even dry land would be turned into another Disney illusion: As you traverse the theme park, you are actually walking on the roof of an immense, underground control building from which the operation is run, staffed, and supplied.

Disney's new empire in central Florida would be marketed as Disney World. Its official name was, and remains, the Reedy Creek Improvement District. Thanks to a sweetheart deal with the state legislature, the lands Disney purchased were detached from the rest of Florida to form a Magic Kingdom, above and outside the law. Even now, Disney World's rides are exempt from state safety inspections. Democratic process is excluded, too. Power remains in the hands of a board of supervisors composed of Disney allies. However much you pay for a time-share condo in Disney World, you cannot buy property outright, and therefore establish official residence, and therefore vote for the board. Celebration, Disney's residential community themed to evoke pre-1940s small-town America, has a city hall but no actual municipal government.

The most telling theme park in Orlando isn't even Disney's. SeaWorld is populated with sharks and whales plucked from the ocean and transported 50 miles inland. (Marineland, Florida's original aquatic attraction on the Atlantic coast, is a fossil of its former self.) Every year, hundreds of thousands of people drive down the Atlantic coast of Florida and turn inland to visit America's premier saltwater attraction. SeaWorld bespeaks the essence of Orlando, a place whose specialty is detaching experience from context, extracting form from substance, and then selling tickets to it.

In this place of exurban, postmodern pioneers, the range of choices is vast even when the choices themselves are illusory. Here life is truly a style: You don't want to live in a mass-produced, instant "community"? No problem. Orlando's developers, like the producers of instant coffee, offer you a variety of flavors, including one called Tradition. Structurally it may seem identical to all the others. Only



instead of vaguely Mediterranean ornamental details, the condos at Tradition have old colonial finishes. In Orlando's lively downtown, it's possible to live in a loft just as you would in Chicago or New York. But these lofts are brand-new buildings constructed for those who want the postindustrial lifestyle in a place that never was industrial.

Orlando's bright lights are not the garish displays of Las Vegas or the proud power logos of New York. Instead, Orlando glimmers with the familiar signage of franchise America: Denny's,

ORLANDO: EXURBAN SPRAWL

After Disney World opened in 1971, "Orlando" became the brand name for the sprawl that is central Florida. America's population is decentralizing faster than at any time in history, and Orlando reflects the trend: In three decades the metropolitan area has grown fivefold in size. Growth is fastest at the city's margins, where the exurbs lure residents with larger houses, new big-box stores, and jobs in the suburbs rather than the city.

Burger King, Quality Inn, Hampton Inn, Hertz. Orlando also leads in the culinary transformation of the exotic into the familiar. From its Orlando headquarters, the Darden Corporation, the city's first *Fortune* 500 company, mass-markets theme foods. It standardizes the output of Red Lobsters and Olive Gardens everywhere.

All over Orlando you see forces at work that are changing America from Fairbanks to Little Rock. This, truly, is a 21st-century paradigm: It is growth built on consumption, not production; a society founded not on natural resources, but upon the dissipation of capital accumulated elsewhere; a place of infinite possibilities, somehow held together, to the extent it is held together at all, by a shared recognition of highway signs, brand names, TV shows, and personalities, rather than any shared history. Nowhere else is the juxtaposition of what America actually is and the conventional idea of what America should be more vivid and revealing.

Welcome to the theme-park nation.

"I FELL IN LOVE with the sense of potential," says Rick Tesch, one of modern Orlando's boosters. "I saw Orlando as a great place to be, globally." Tesch could be talking about franchising car rental agencies. Instead, he is talking about religion. In the 1980s, Orlando's civic elite had decided it could be a leader in faith as well as theme parks. For Tesch, a devout man working for the Orlando Economic Development Commission at the time, the opportunity to lure religious organizations to the Orlando area was a privilege as well as a challenge.

One prime target was Bill Bright, the late

THE ACRES OF CITRUS GROVES IN ORANGE COUNTY HAVE DECREASED

93 PERCENT IN THE PAST FORTY YEARS.

founder of the Campus Crusade for Christ. Like Disney, Bright had started out in southern California; his spiritual enterprise, like Disney's entertainment enterprise, soon needed more growing space. Tesch set out to prove that Orlando was just the place for the Campus Crusade to put down roots. Orlando's Hometown U.S.A. persona was a draw. So was the fact that, in religion as in other fields, Orlando was on the cusp of mighty changes in America. Originally a southern prong of the Bible Belt, Orlando was morphing into a stronghold of Middle American spiritual as well as cultural values, a result of massive migration out of the central United States into central Florida.

God wants me to come here, Bright is reported to have said after an exploratory visit. So did the Orlando Economic Development Commission. Working with civic leaders and private donors, it helped broker a deal in which the Campus Crusade for Christ, in exchange for establishing its new World Center for Discipleship and Evangelism in Orlando, was given 165 acres of land, for free. The equivalent of Disney's Reedy Creek deal, it hastened Orlando's transformation into an important nexus of religious enterprise. Today dozens of megachurches and religious organizations, many with multimillion-dollar budgets, are located in the area.

The megachurch is the culmination, at least so far, of the integration of religious practice into the freeway-driven, market-savvy, franchise form of American life. The emergence of Orlando's largest megachurch, the First Baptist Church, from a small congregation into a powerful, wealthy organization, parallels Orlando's own transformation. The turning point came, as in many Orlando stories, when a sense of mission intersected with a real estate opportunity.

In the early 1980s, First Baptist's pastor, Jim Henry, believed the church should get out of Orlando's downtown. He had arrived in 1977 from rural Mississippi. "I felt this town was going to take off. It had good connectedness: spiritual, business, political connectedness," he says. He foresaw that the old downtown would no longer be the epicenter of Orlando. At his instigation, the church formed a search committee. "I told the people looking for land, 'Look 150 years ahead.' I wanted us to move to where the new center of Orlando was going to be," he says.

When the group found a parcel of 160 acres located near the intersection of two freeways, offering access to both Disney World and the airport, Henry knew First Baptist had found its promised land. Today the church offers the same assemblage of green space, ample parking, and low-slung buildings you find in Orlando's better commercial parks and residential developments. Its growth has come from customizing its services to the needs of a community that craves a sense of connectedness. It offers parenting workshops, game rooms for teenagers, and support groups for divorced people. "We've done what Wal-Mart and football have," Henry says. "We've broken down the idea that 'big is bad.'"

His church's physical transformation has been accompanied by a philosophical change. "We are not here to dictate our faith," says Henry, a past president of the Southern Baptist Convention. He was one of the movers behind the Southern Baptist decision to issue a formal apology to African Americans for the convention's past support of slavery and segregation. Henry also opposed the Southern Baptist boycott, now lifted, of Disney World because of its toleration of openly homosexual visitors.

It's been a revealing journey, from a small Mississippi congregation to an Orlando megachurch that is not only bigger, but more diverse than seemed imaginable. In the process, Henry, who's now retired as pastor, has become an authority on megachurch growth management. His book *Dangerous Intersections* shows churches how to cope with their growth. As Henry explains it, one of the trickiest things about getting people to

worship is getting them in and out of the parking lots. At First Baptist, sermons are coordinated with the time required to get one congregation into their cars and back on the freeways. A system of color-coded signals keeps preachers from talking too long, creating traffic jams on the access ramps and chaos in the parking lots.

"You begin with faith," Henry says, and in his case at least, you end up as an expert in traffic management.

VERY FEW PEOPLE, as they talk about the immense changes reshaping Orlando and their lives, mention another American genius who left his mark here even before Disney arrived. Jack Kerouac—guru, bad boy, the literary superstar who wrote the Beat Generation's manifesto, *On The Road*—came to Orlando, by bus, in December 1956. The following year, in an 11-day creative frenzy, he wrote *The Dharma Bums* in an apartment with a tangerine tree out back, shoveling the words through his typewriter in the heart of hot, flat Florida.

Kerouac's tumultuous vision was a howling rant against the plastic shackles he perceived imprisoning the human spirit in mid-century America. Looking out his window at the neighbors, he scorned "the middle-class non-identity which finds its perfect expression . . . in rows of well-to-do houses with lawns and television sets in each living room with everybody looking at the same thing and thinking the same thing at the same time." Whereas Disney was looking for control, Kerouac personified the American urge to defy control. Disney acted out the old American idea that if you can just grab hold of enough American wilderness, you can create a world free of the problems that besiege people in places like the frost belt. Kerouac evoked a rootless America where, no matter how far people wander, they never reach their destination.

Never were two men so totally American and so totally different, yet both of them wound up

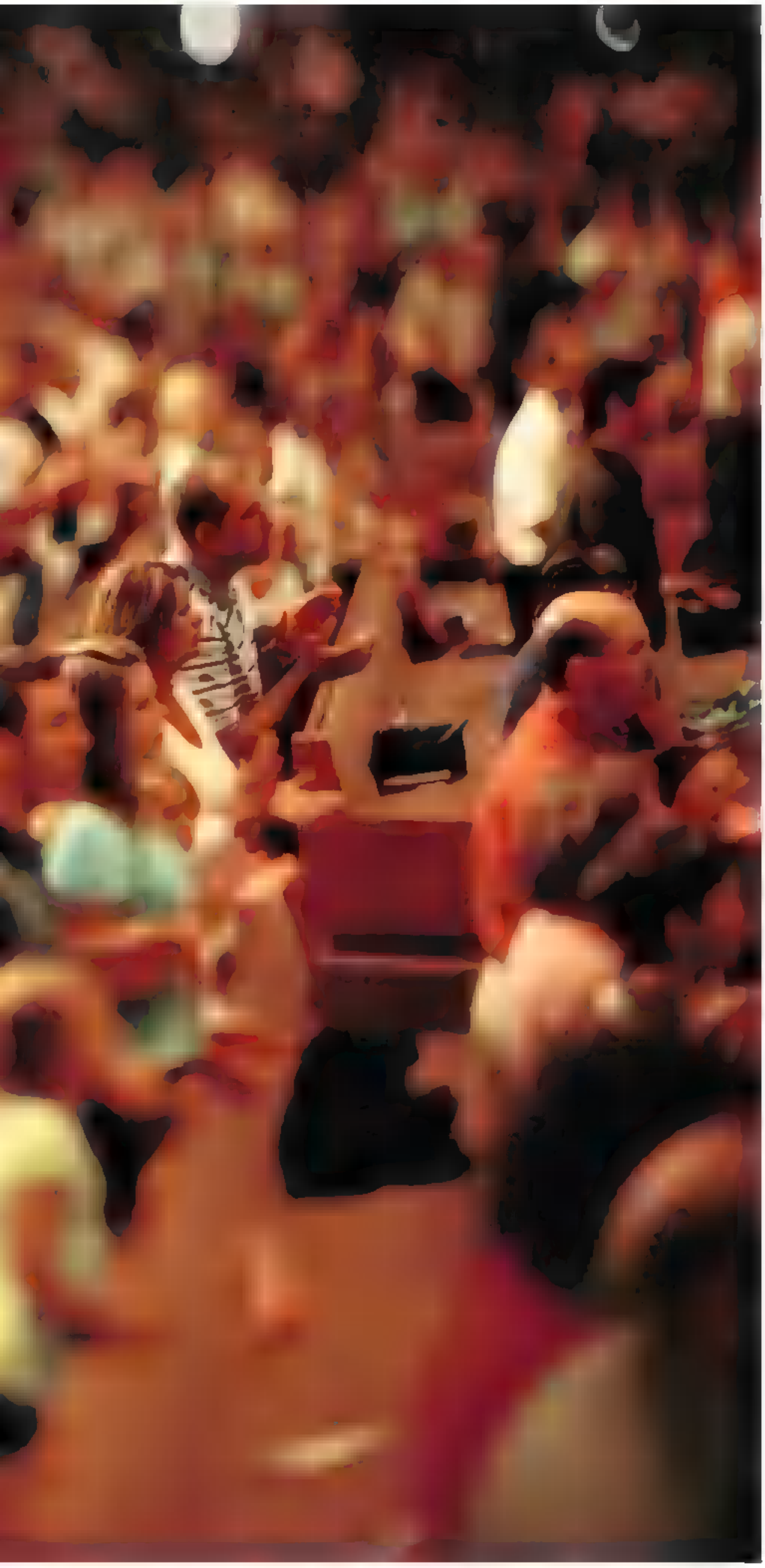
Disney acted out the American idea that if you grab hold of enough wilderness, you can create a world free of problems.

in Orlando. This prophetic convergence raises the question: When it came to America's future, who was the better prophet of what, since then, we and our country have become? As a people, and as a nation, are we more like Disney's smiling "characters"? Or do we more resemble half-lost wanderers, like Kerouac and his crew?

The answer seems clear: Around the world, Orlando is synonymous with the theme-park culture that has overtaken America. Nowhere else does the triumph of the Disney ethos seem so total, yet something paradoxical emerges when you get to know the place. Fifty years on, Kerouac's restless spirit is still on the loose in Orlando's discount shopping malls. It prowls the RV parks and hangs out at the fast-food franchises. Wherever people neglect to mow the grass, or curse the car payments, you're in Kerouac's Orlando because they, like him, were once from someplace else. And, for a while at least, Orlando seemed to them, as it did to the Beat apostle, like a place where the utility bills never get past due and the past can never haunt you.

"Why not come to Orlando and dig the crazy Florida scene of spotlessly clean highways and fantastic supermarkets?" Kerouac wrote Lawrence Ferlinghetti, the Beat poet, in 1961. But in Orlando, as everywhere else he roamed, Kerouac never did find escape. Florida became for him, after he stopped writing, a place to drink, and ultimately a place to die. The little house at 1418 Clouser Avenue where Kerouac wrote his novel now serves as a kind of literary time-share, where writers spend three months at a stint, hoping to channel Kerouac's manic genius.

Things did not turn *(Continued on page 112)*



1,210

U.S. PROTESTANT CHURCHES HAVE WEEKLY ATTENDANCE OVER 2,000—NEARLY DOUBLE THE NUMBER FIVE YEARS AGO.

More mall than cathedral, megachurches like First Baptist of Orlando serve as community hubs for decentralized cities. Its very size is a draw. "There's ■ sense of excitement, of something going on," says pastor David Uth.

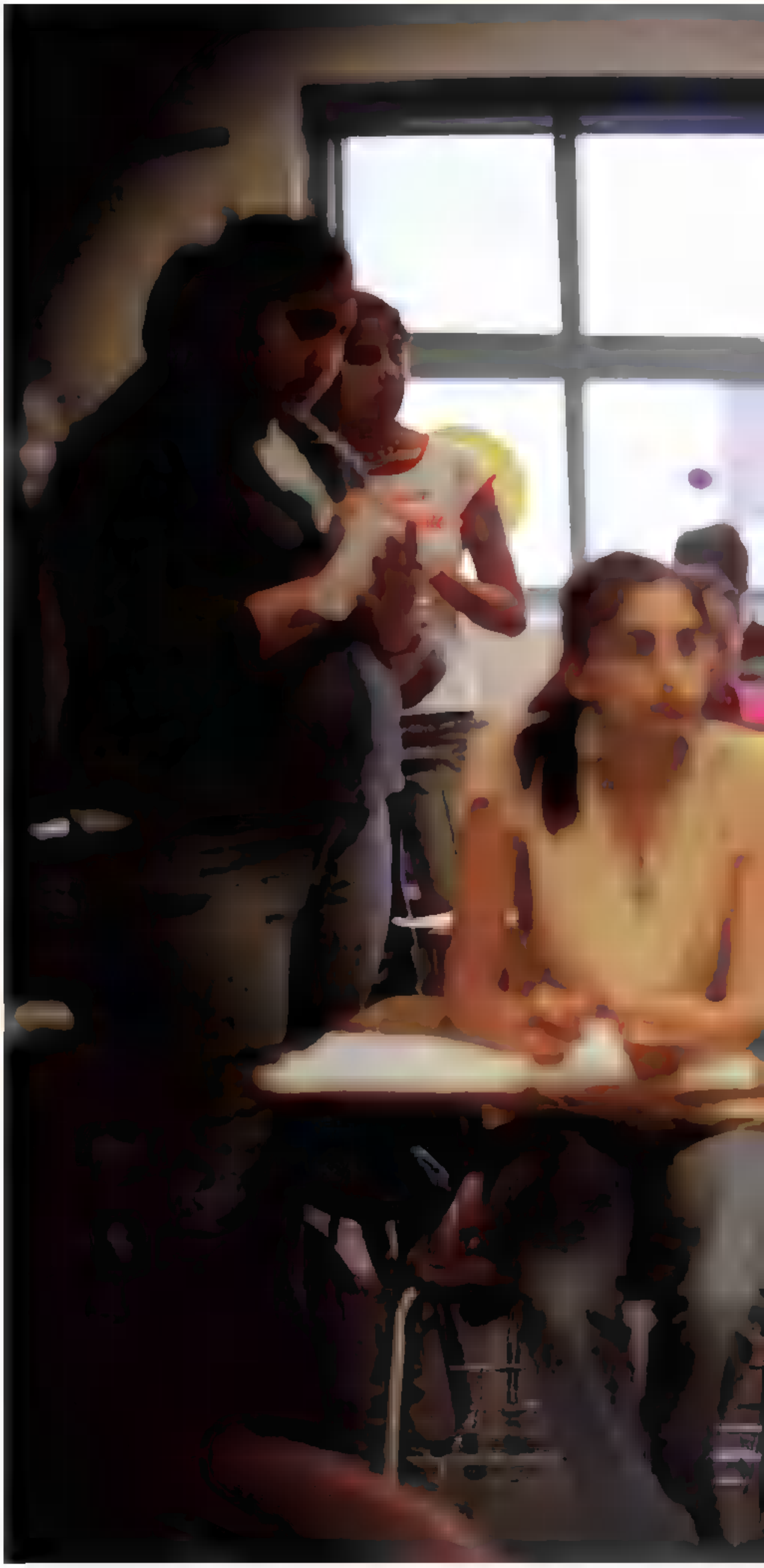
Orlando leads in the culinary transformation of the

The Homestyle Café in historically black Eatonville serves smothered chicken, pork chops, collard greens, and chitlins—authentic tastes in Orlando's franchise world. "It's the food we were raised up on," says owner Lisa Grant, whose chef is a retired school cafeteria cook.

exotic into the familiar, the marketing of theme foods.

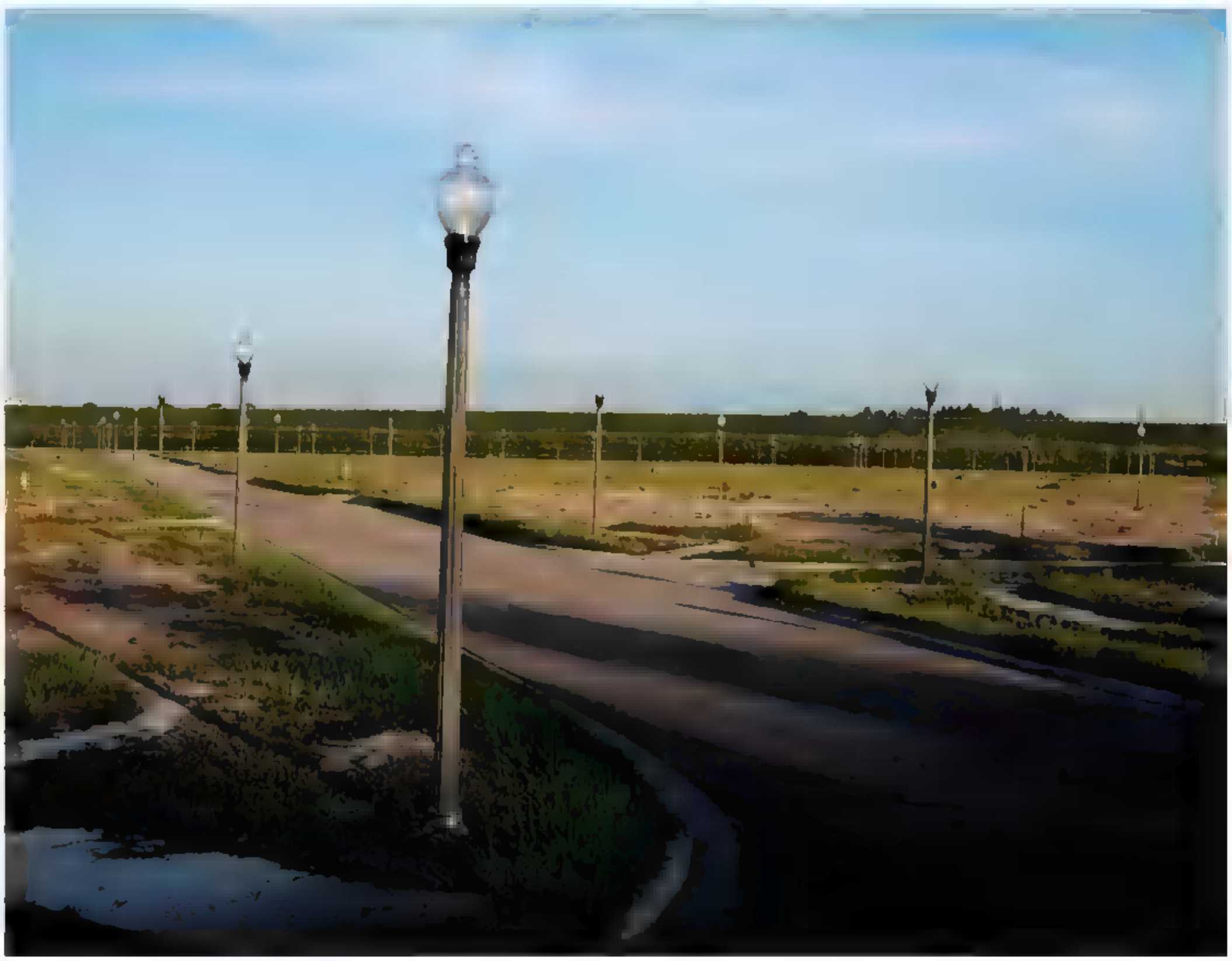
In Red Lobster's test kitchen—birthplace of popcorn shrimp—dishes are tasted again and again en route from the Orlando corporate headquarters to menus at 682 locations nationwide. "We ask, 'Does it move our brand forward?' " says corporate chef Michael LaDuke, third from left.

28 PERCENT
OF PEOPLE LIVING IN AMERICAN SUBURBS
ARE ETHNIC MINORITIES.



Debate students at Orlando's Cypress Creek High speak six languages besides English—Hindi, Gujarati, Urdu, Mandarin, Japanese, and Creole. As immigrants pass up gateway cities like Miami for better schools and affordable homes, suburbs are no longer homogenous enclaves.

What happens to the land once it stops producing what



Streetlamps mark the future homes of Savannah Landings, a development on Orlando's east edge where town houses named Scarlett and Ashley will go for $236,000 and up. Best perk in ▪ far-flung city with no trains and few buses: easy access to Route 417.

the juice ads once called liquid sunshine?

Towers of sod will soon carpet the yard of a five-bedroom house with three-car garage far outside Orlando. Increasingly, Americans are escaping the pull of cities to create new utopias in the exurbs. "We wanted more space, more countryside," says owner Rick Khan.

"Just because we've ruined 90 percent of everything doesn't mean we can't do wonderful things with the remaining ten percent!"

—LINDA CHAPIN,
former Orange County commissioner

(Continued from page 103) out as Walt Disney intended either. People thronged to the Magic Kingdom to see with their own eyes what they'd seen on TV, but Epcot, Disney's cherished project of creating a futuristic community where people lived and worked in high-tech harmony, never became a reality. People weren't interested in Disney's edgeless version of tomorrow. Epcot was such a failure that Disney officials faced the embarrassing prospect of shutting it down. Instead, they turned it into another tourist attraction. Today Epcot offers a nostalgic pastiche of a 1940s seashore vacation 60 miles from the nearest sea, along with food options themed to places like Gay Paree, a space ride, and "Key West" time-share options.

By trying to create a Magic Kingdom immune from squalor and complexity, Disney touched off an orgy of uncontrolled growth that still shows no signs of abating. Extinct theme parks litter the Orlando landscape the way dead factories mark the rust belt. Defunct attractions like Splendid China, which featured a miniature Great Wall, went bankrupt because they were too realistic. They failed to provide what all successful theme parks must: fantasies conforming exactly to what the paying public expects to get.

Today Orlando is a cauldron of all the communal characteristics Disney sought to control. In its Parramore district, you can stock up on crack, meth, and angel dust. According to the Morgan Quitno research firm, in 2006 it joined such cities as Detroit and St. Louis to become one of the 25 most dangerous cities in America. The result is armed guards at the gates of "communities" where entry is solely by invitation. The Orlando area also has one of the highest pedestrian death rates among the largest metro regions in the country. Four decades after Disney's fateful flyover, Orlando is a place of enormous vitality, diversity, ugliness, discord, inventiveness, possibility, and disappointed hopes, where no clown in a character costume can tell people how to live, let alone where to park.

ON THE AFTERNOON of Wednesday, February 2, 2005, thousands in Orlando got a shock when they turned on their car radios for the drive home. The Supremes had been banished; Kenny Rogers had been given the boot. Without warning or explanation, FM 100.3, Orlando's famous "golden oldies" station (known as the Big 100s), had vanished. Rumba 100.3, new home of central Florida's hottest Latin sounds, had taken its place. To oldies fans, it was as though Hispanics with boomboxes had somehow gotten inside the car.

The incident provides a defining parable of Orlando today. Twenty-five years ago, Orlando seemed a safe haven to those seeking to avoid the immigrants pouring into Miami and reshaping life all over the country. "Will the last American to leave please bring the flag?" the saying went. But as the sudden death of the Big 100s demonstrated, Miami was a forecast, not an aberration. Today there are about 400,000 Hispanics in the Orlando area—20 percent of its entire population.

The unannounced intrusion of Rumba 100.3 indicates something more than Orlando's expanding ethnic diversity. A generation ago, Walt Disney's secret decision transformed Orlando's destiny without anybody being asked whether they wanted it or not. Now another secret decision, this time by faraway executives at Clear Channel Communications, the giant radio conglomerate, had determined what kind of music people in Orlando would hear. The growth of Orlando's Hispanic population itself

THE SIZE OF AN AVERAGE AMERICAN HOME HAS INCREASED

63 PERCENT OVER THE PAST THREE DECADES.

was touched off by a marketing decision. Back in the 1990s, when a real estate company was having trouble selling property in a development called Buenaventura Lakes, their marketing department decided to advertise in Spanish in the major newspapers in Puerto Rico. Suddenly Puerto Ricans were flowing into the Orlando area—creating an alternative to predominantly Cuban Miami for Hispanics in Florida.

Today Orlando is as multicultural as New York, and as much in the throes of globalization as any import-export center. Its growth has brought people speaking more than 70 languages to central Florida. Kissimmee, south of Orlando and just east of Disney World, has gone from being a cowboy town to mostly Hispanic in less than ten years. The tentacles of diversity have penetrated Disney World too. Few tourists realize it, but when their kids hug Goofy and Minnie they might be embracing low-wage workers from places like Sri Lanka and the Dominican Republic.

Some complain the newcomers from developing countries aren't "real Americans." Others complain the newcomers from up north aren't "real Floridians." "We have drive-by citizens," says Linda Chapin, a former Orange County commissioner. People move to Florida, but they don't bring their loyalties with them. In such a situation of psychological rootlessness and moral detachment, the question isn't whether the problems arising from unchecked growth can be solved. It's whether there is any chance of them being addressed at all.

"We've allowed Florida to be turned into a strip mall," says Chapin. "This is our great tragedy." While she was head of the county commission, she played a major role in unleashing Orlando's nonstop building boom. She masterminded Orlando's new convention center, along with other projects intended to assure an influx of people into the area. "My name is in gold letters over at the convention center," she says. "It makes my mother proud." These days, as head of urban planning at the University of Central Florida, she thinks up ways to slow down Orlando's growth, and humanize it.

Chapin is one of the very few movers and shakers in Orlando who was born here. Back then, of course, the lakeside house where she still lives was not considered part of Orlando. It was way out in the country. Today it's on the downtown side of both the airport and Disney World. Once this was Eden. Now the orange trees have been stripped from the landscape. Planes whine as they prepare to land at Florida's busiest airport. Nearby, South Orange Blossom Trail is a six-lane case study in ugliness, offering everything from wholesale adult videos to genuine south Indian vegetarian cuisine. Still, the old Chapin place has what people in Orlando miss the most: authenticity. "We are here; we are nowhere else," say the shallow muddy water, and the heavy air, and the Spanish moss with the little red bugs in it.

Chapin talks about the reasons why, back in the beginning, change and growth seemed like such unalloyed blessings. "We thought we could manage growth," she says. In her lifetime, a sky's-the-limit scenario has turned Orlando into a city of suburban, and human, dilemmas. Still, this is can-do America. As Linda Chapin, suddenly reverting to optimism, puts it: "Just because we've ruined 90 percent of everything doesn't mean we can't do wonderful things with the remaining ten percent!"

YOU CAN SEE Orlando's sprawl from outer space. Go to Cypress Creek High and Meadow Woods Middle School, and you see the human complexity in the eyes of its students. The sky was streaked dawn pink as I headed out to the moving edge of Orlando. Fifteen miles southwest of downtown, I reached the latest spot where central Florida's population explosion has turned wilderness into tract housing overnight. If the

AMERICANS SPEND THE EQUIVALENT OF

10 WORKING DAYS A YEAR COMMUTING TO WORK.

moon were ever settled, this is how it would be done. Whole neighborhoods, consisting of hundreds of houses, arrived here instantly. So have the people who live in them.

Demographically, these two schools match the Orlando area. Here both whites and blacks are in the minority; "other" is the dominant ethnicity. I picked them because they are typical schools, but when I visited I found something extraordinary—two places where more than 8,000 students and teachers were finding new ways to learn, and new ways to live together.

At Cypress Creek and Meadow Woods, great events are not just things these kids and their teachers see on TV. They impinge on people's lives. At Cypress Creek, the assistant principal, Vanessa Colon Schaefer, was still putting her life back together after more than a year in Iraq. When her National Guard unit was sent there, she left a gap in the life of her daughter, and of this school. Kids from nearly 200 countries study at the two schools. "Normally they shout out their countries when I ask them," says Chuck Rivers, the principal at Meadow Woods. "But one time a little boy just whispered. When I asked him again, he kept whispering, so I bent down to hear him. He whispered 'Iraq' in my ear." Rivers adds, with no false sentimentality, "They're all my kids."

I talk to students from Colombia, Brazil, Haiti, Jamaica, Korea, China, the Philippines, Iran, Russia, Slovakia, and India—and I've just begun to plumb the mutations. "My mother is from Germany," one little girl says, "and my father is from Madagascar." Diversity is not an objective, or a program, or a lifestyle here. It is life.

At Cypress Creek I talk with the school's National Merit Scholars. I visit classes where kids are autistic or deaf or otherwise different. I sense how important it is for children to find themselves integrated, every day, with kids who are different from them mentally, physically, racially, culturally. The principal of Cypress Creek is a woman; the principal of Meadow Woods is black. He remembers the days of racial segregation. Now he is in charge of a learning experience where racial barriers aren't the only things that have become meaningless. No dumbing down is going on here. At the middle school, kids are studying things I never learned in all my years of schooling: how to conduct a symphony, how blood circulates, how to fix a faucet, how to solve disputes openly and nonviolently. As we leave, the principal says something that sticks in my mind: "We do this every day."

ONE MORNING I HAVE what people in Orlando call the I-4 experience. I zoom off in my car for a midday appointment. It turns into an afternoon appointment by the time I get there. For most of an hour, every car sits motionless. For the first time I truly understand what people mean when they call I-4 "Orlando's parking lot." Nothing is more obvious than the need for a light-rail system connecting Disney, downtown, the airport, and points in between. But in Orlando people love their cars as much as they hate paying taxes. Orlando's roads, so recently slashed through the wilderness, are already deteriorating.

Being stuck in traffic gives you time to think; I wind up thinking about how different Orlando's image of itself is from reality. The irony of Orlando is that people go there in search of Disneyesque tranquillity—and by doing so, they've unleashed upon the place all the rootless, restless contradictions of America. Here is big city traffic, big city crime, yet people in Orlando cherish the idea that they have escaped the trials people face in other cities. On this morning, it is cold, so cold I turn the car heater to high—though at most times of year it is stultifyingly hot. Ahead of me is an overpass, and just to complete the refutation of Orlando's all-American self-image, a big semi lunges across the overpass.

Disney vs. Kerouac Debate the pros and cons of Orlando's over-the-top growth at **ngm.com/0703**.

The gospel according to Disney is a message of self-fulfillment, of wanting something so badly that your dreams really do come true.

"Lucky Noodles," giant red characters proclaim, both in English and Chinese; it is carrying supplies for Orlando's Asian supermarkets.

For some reason the truck with the graceful Chinese writing on it reminds me of the lyrics of that old Disney theme song:

When you wish upon a star
Makes no difference who you are
Anything your heart desires
Will come to you.

"If your heart is in your dream," the song goes on to allege, "No request is too extreme."

Walt Disney was silent on the subject of religion; there is scarcely a mention of God in his more than 40 animated movies and none of his theme parks includes a church. Instead, the gospel according to Disney is an optimistic message of self-fulfillment, of wanting something so badly that your dreams really do come true. The results are visible everywhere you look in Orlando.

Orange County no longer produces oranges. Frost, disease, and development have destroyed the groves. What happens to the land once it stops producing what the juice ads once called liquid sunshine? One day I visit a former orange grove that is now named Isleworth. It is Orlando's most exclusive gated community. Homes sell there for millions of dollars, though the land—your typical lakeside lots—and the houses—McMansions ranging from the merely huge to the stupendously gargantuan—account for neither the prices nor the prestige. People pay so much to get into Isleworth because here too they are buying admission tickets to a dream. In this case the dream is rubbing shoulders with the likes of Tiger Woods. Arnold Palmer first bought land here when he came to Orlando, and in less than 20 years it has become Orlando's equivalent of old money.

Not far away, in Kissimmee, U.S. 192 is full of long-lease motel rooms for families who can't afford to lease apartments, of miniature golf courses for people who will never play at Isleworth. The road connects I-4 with Florida's Turnpike, and it's become a dumping ground for everything, including dreams, that gets funneled down into central Florida. Near a sign offering cut-rate helicopter rides, the whirring machine sits, engine revving, rotors spinning, right next to the highway, on a lot no bigger than someone's front yard.

I might end this Orlando odyssey right there, with the great American getaway having left us all lost in Kissimmee, except Orlando has taught me that, even in the oddest places, the human spirit can be exalted. Orlando shows us that, despite our American urge to construct utopias, the real wonderland remains our diversity and unpredictability. At Cypress Creek High School, one student told me: "I found beauty in Kissimmee." Eric Strunz, a senior at the time, was a pilgrim lost in a spiritual desert when he found it. "A Buddhist temple, right there in Kissimmee," Eric said. "I took off my shoes and went inside. I loved the calm, the serenity. It changed my life. I realized for the first time there were other ways of understanding the world."

Later Eric emailed me the address of the Buddhist temple's website. I found out that Wat Florida Dhammaram wasn't another "attraction" with a Buddhist theme, where you paid admission to be herded through a cartoon version of a foreign culture. This was a real temple, built to serve the spiritual needs of central Florida's growing Buddhist community.

By leaving Disney World, I had at last found America's true Epcot, just as Eric had found his Kerouac revelation.

"The monk blessed me," he remembered. □

Ignoring the bar jacks before its nose, a tiger shark prowls the shallows in search of bigger prey. Persecuted around the globe, sharks enjoy safe haven in the Bahamas—at least for now.

GALEOCERDO CUVIER

BLUE WATERS OF THE BAHAMAS AN EDEN FOR SHARKS

Blacktip and Caribbean reef sharks swirl with jacks and snappers off Walker's Cay. Hurricanes wiped out a shark tourism operation here in 2004, but the big fish still congregate in big numbers—as do island developers hoping to revive the storm-torn cay with a new resort.

CARCHARHINUS PEREZI; CARCHARHINUS LIMBATUS

Grisly fame follows the oceanic whitetip shark—often the first scavenger to arrive at sinking ships and downed planes. Despite its reputation as a devourer of humans stranded at sea, this nine-foot long whitetip swam past biologist Wes Pratt without incident

CARCHARHINUS LONGIMANUS

Primordial in appearance, the great hammerhead is actually one of evolution's most advanced sharks. Wide-set eyes and nostrils provide keen peripheral senses. Tiny electroreceptors visible on its snout help it pinpoint prey. Serrated teeth do the rest.

SPHYRNA MOKARRAN

by JENNIFER S. HOLLAND • *photographs by* BRIAN SKERRY
NATIONAL GEOGRAPHIC STAFF

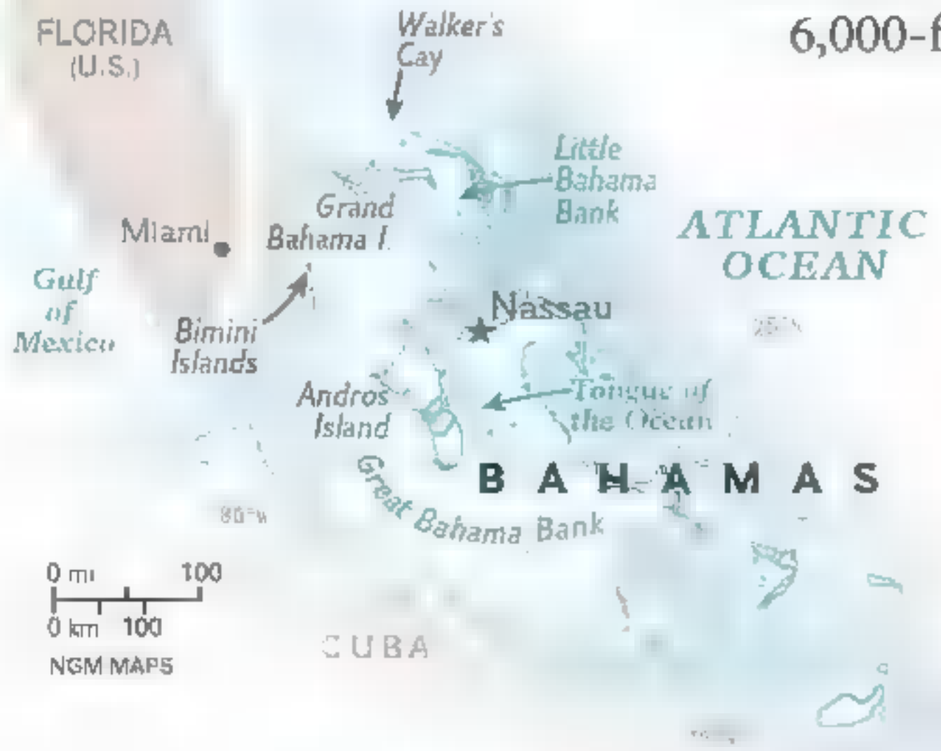
There's no denying that sharks have an image problem. The serial-killer stare, the obscene grimace of warped teeth, the bloody feeding frenzies—it's no wonder they've been difficult to love as long as we've known them. And writers haven't always helped their cause.

"Pale ravener of horrible meat," Herman Melville wrote of the shark, with its "saw-pit of mouth," its "ghastly flank," its "Gorgonian head." On years-long voyages aboard whaling ships, the famous 19th-century teller of sea tales witnessed sharks devour the offal of butchered whales—"horrible meat"—which goes a long way toward explaining his uncharitable view.

The Bahamas might have changed his mind. Ernest Hemingway, who in the mid-1930s hid out in the islands with his typewriter and rods, was stirred to write of fish and fly lines and the steady pull of the sail. True, he railed against sharks that ravaged his catches faster than he could crank the reel. (He killed scores of them in reprisal, shooting them and burning their bodies on the beach.) But though he often vilified sharks, sometimes he wrote of them with reverence. Says Santiago in *The Old Man and the Sea,* of a mako shark breaking the surface, "Everything about him was beautiful except his jaws. . . . He is not a scavenger nor just a moving appetite. . . . He is beautiful and noble and knows no fear of anything."

The Bahamas is still much as Hemingway experienced it, its waters clean and teeming and blue. Most of the archipelago—some 700 islands and cays scattered for 500 miles southeast of Florida—remains free of industrial development. Locals still make a living off Bahamian lobster, snapper, and conch; sportsmen still take bonefish from the sand flats and marlin and sailfish from the cold 6,000-foot-deep chasm called the Tongue of the Ocean.

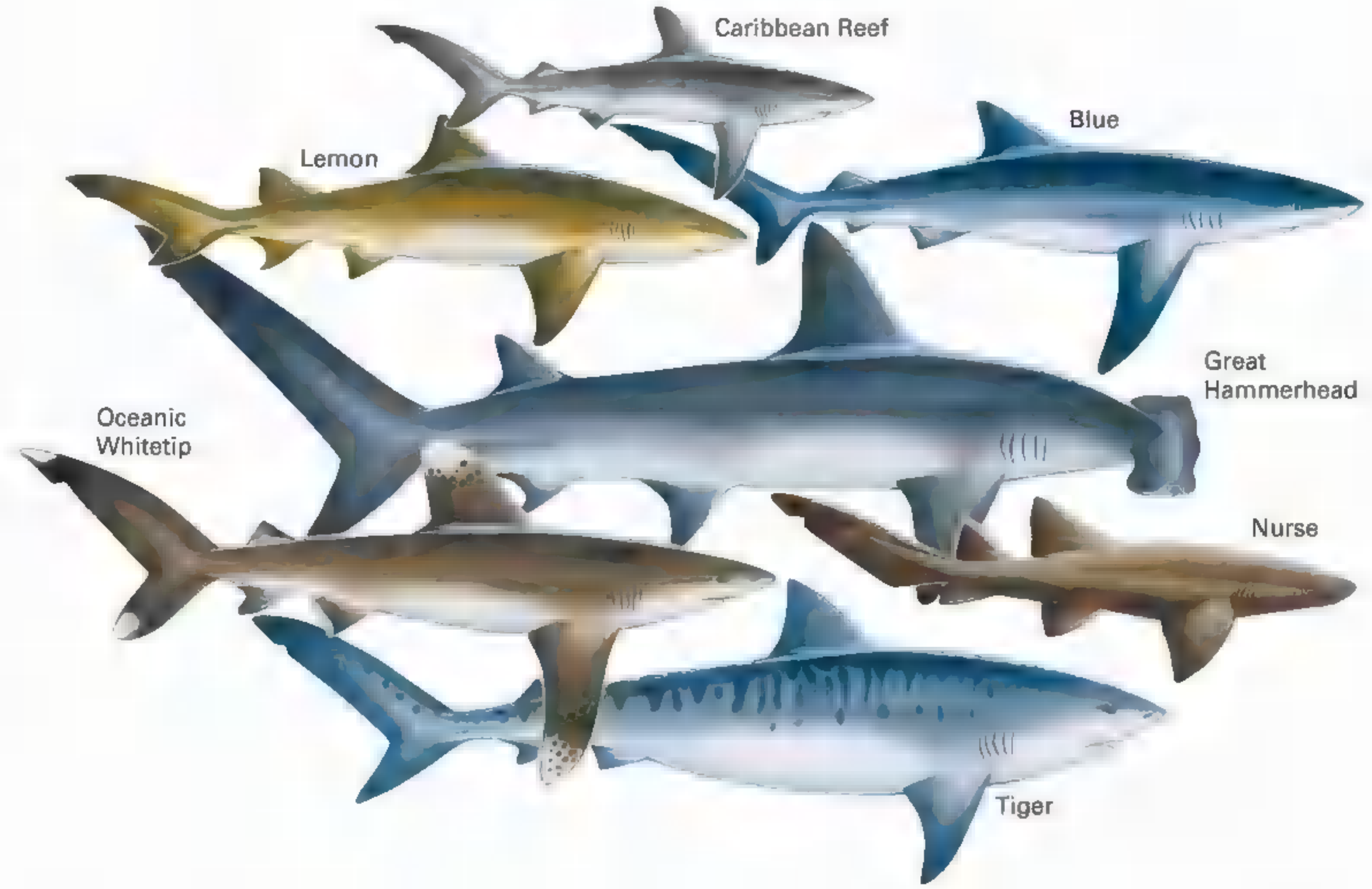
The sharks, too, are still here. At a single dive spot called Tiger Beach, a dozen or so tiger sharks circle, not in the manner of vultures, but more like a mobile above a child's bed. Their dark, watchful eyes are the size of fists, and subtle spots and bands stain their skin like batik. After the great white, this species is said to be the world's most dangerous shark. It will eat anything—other sharks, license plates, tires. The big female that breaks formation and heads my way passes so close I can make out the



A stippling of islands, cays, sand flats, and coral reefs makes the Bahamas an ideal setting for sharks and those who study them. In a knee-deep lagoon in Bimini, biologist Samuel "Doc" Gruber (below) examines a lemon shark pup.

Growing up in a shark-eat-shark world, a lemon pup enjoys safety and sustenance among mangrove roots bordering a lagoon. Food-rich waters from the Gulf Stream flush through at high tide, fattening up the edible creatures that keep the pups fed and close to home.

NEGAPRION BREVIROSTRIS



As diverse as the habitats that support them, more than 40 shark species (an assortment, above) inhabit Bahamian ecosystems. Reef sharks are likely the most abundant residents; blues are the great wanderers, traveling some 2,000 miles seeking food or mates.

pores that pepper her snout and enable her to sense the electromagnetic energy of living flesh. As she slides by, huge and silent, I reach out and run a hand over her side. It's like fine-grain sandpaper. Her movements stay steady and calm as she rejoins the circling sharks. For a fish with a vicious reputation, this one makes a disarming first impression.

Big tigers aren't the only sharks that flourish here. More than 40 other species cruise Bahamian waters, including lemons, great hammerheads, bulls, blacktips, makos, silkies, nurses; even migrating blues and massive whale sharks pass through. Others live here year-round, giving birth in the same quiet lagoons where they were born. And fishermen continue to curse the marauders that gut their quarry, leaving nothing to reel in but lips and gills.

The name Bahamas comes from the Spanish, Baja Mar, for "shallow seas." The archipelago rests atop a pair of limestone platforms, the Great and Little Bahama Banks, divided by channels that plunge as deep as 13,000 feet. It's this combination of sheer drops and shallows, of rocky ledges and sandy shores, of coral reefs, grass flats, mangroves, and quiet lagoons, that nurtures life of all sizes. Clean Atlantic waters and a warm current from the Gulf blend to create a seafood feast that draws sharks from near and far. For now, this clean blue place is their Eden.

IN A SECLUDED POOL hemmed by mangroves, baby lemon sharks roll in the shallows and nip at the surface of the windowpane water. "This place is extraordinary," says Samuel "Doc" Gruber, a biologist who runs a shark research station nearby. This tiny lagoon

ART BY SHAWN GOULD

in the strand of Bahamian islands called Bimini is a natural shark nursery, a birthing and feeding area where young lemon sharks can eat and grow without being eaten themselves. Gruber was led here a couple of years ago by a shark stoolie of sorts, an adult female fitted with a tracking device.

As we wade through the lucid pool, small fish dart among mangrove roots that spider in all directions, and crabs skitter into hiding. The tidal forest is dense and deep green, sheltering birds that break the quiet now and then, one coughing up song like a truck engine that won't start. But mostly there's just breeze in our ears as the young sharks, hardly bigger than wine bottles, graze our ankles, sending chills up our spines.

With sunglasses, beard, and red bandanna around his face to block sun and mosquitoes, Gruber looks more outlaw biker than marine biologist. Kneeling in a swirl of sandy water, he tries to lure sharks into reach by flicking bits of bait at them and crooning "Ma Chérie Amour." He swears loudly when they ignore his overtures, but then, with a pup finally in hand, he coos like an adoring mother. He shows how the young shark, when flipped on its back, slips off to a sleeplike state called tonic immobility.

Sharks bite fewer people each year than New Yorkers do, according to health department records. And you are far likelier to drown in your bathtub or be murdered by your spouse than you are to die in the jaws of a shark. Yet it's still difficult to win public support and dollars for shark research and conservation. Gruber's lab on South Bimini is clearly a duct-tape-and-string operation. Torn fishnets festoon the yard. The lab's donated truck, when it runs, fills quickly

"This is one of the few places in the world where people can interact with wild sharks close up," says Stuart Cove (feeding a reef shark). Cove's dive resort is one of 20 that draw thousands of tourists annually and together pour some 250 million dollars into the Bahamian economy.

Society Grant

This research is funded in part by your Society membership.

The presence of sharks, such as these Caribbean reef sharks, makes for a healthy ecosystem. As top predators, they help keep other carnivores from becoming too numerous and depleting herbivorous species. Benefits accrue to everything—from snappers to sponges.

CARCHARHINUS PEREZ

Hungry for smaller sharks, rays, and fish, a great hammerhead swims with head swinging from side to side to widen its search. Tiger sharks (opposite) will consume almost anything: During a dive for this story, a tiger was seen munching a basketball-size conch, ground-up shell puffing like smoke from its gills.

SPHYRNA MOKARRAN; GALEOCERDO CUVIER

with noxious exhaust (a passenger needing air has to ride holding the door ajar). Volunteers who do most of the grunt work share a double-wide mobile home painted in loud colors. The food is off-brand, the bread soft and white, the bunking arrangements chummy. The mostly twentysomethings look sleep-deprived and hungry, but they still eagerly line up to do hands-on research in a place where sharks still thrive.

The self-described "shark geeks" spend long nights working by moon and flashlight in open stretches of Bimini's North Sound, wading along a lattice of nets, carefully untangling captured lemon sharks and rushing them to a pen to be studied and later released. Nearly every pup that moves through the sound is caught this way. Each is weighed, measured, tagged, and its dorsal fin snipped for DNA studies to help the researchers build a lemon shark family tree. More than 90 percent of the tagged sharks that survive their first year are caught again in subsequent years, their health and growth recorded for comparison. Gruber boasts about this recapture rate the way brokers brag about their rate of return. But the real credit goes to the mangrove forests, whose isolation and bounty keep generations of lemons close to home.

Gruber has been studying Bimini's lemon sharks for some 25 years, amassing a detailed database that's the largest for any shark population anywhere on Earth. His findings on how sharks affect their environment and what they need from it confirm, along with numerous other studies, the life-giving nature of mangroves—which is one reason the biologist is fighting mad about a contentious and outsize resort elbowing its way onto tiny North Bimini Island.

Condos, a marina, and a casino are already under way, and plans call for a waterside golf course. Local Bahamians are worried about their shrinking access to fishing grounds as the seafloor is dredged and the land locked up in gated communities. Gruber has his own concern: the mangroves. "They'll all be wiped out if the developers have their way," he says. "The North Sound will be the 18th hole. You can have your mai tai there."

But Gruber admits that Bimini and some of the other smaller islands need better amenities for visitors, whose spending is crucial to the local economy. It's a difficult balancing act: Development done right, gentle on the environment and drawing tourists in manageable numbers, can help protect sharks and their ecosystem, Gruber says. But too much development or environmentally unsound practices can destroy them.

As recently as 2002, plans were in motion to set aside five marine areas to preserve the economic and ecological lifeblood of the Bahamas, with Bimini rated as the highest priority. But a change in government put off the project, and there's been no movement toward protection, despite angry prodding and accusations of corruption. Instead, giant resorts such as the one being built on Bimini have grown up on several outer islands. "The government is selling off this environment, cheap," Gruber says. A staffer at the Bahamas tourism office didn't exactly disagree. "We are a young country," said Leonard Stuart, referring to the Bahamas' 1973 independence from Britain. "We have to learn our own lessons about our environment, and we'll probably make mistakes."

The ramifications could be costly. Tourism accounts for nearly half

SHARKS BITE FEWER PEOPLE EACH YEAR THAN NEW YORKERS DO, YET IT'S STILL DIFFICULT TO WIN PUBLIC SUPPORT AND DOLLARS.

Its long pectoral fins prized for soup, the oceanic whitetip is critically endangered in many areas. Research by scientists such as Wes Pratt of Mote Marine Laboratory (in diving cage) is key to sharks' survival. Says Pratt: "If we don't get to know them, we're gonna lose them."

CARCHARHINUS LONGIMANUS

SCIENTISTS WARN THAT MANY SHARK POPULATIONS COULD BE DANGEROUSLY DEPLETED WITHIN A DECADE, BARRING BOLD ACTION.

the gross national product of the Bahamas. Diving is a multimillion-dollar industry here, and sharks are an ever increasing draw. By Gruber's back-of-the-envelope estimate, a single live shark in healthy habitat is worth as much as $200,000 in tourism revenue over its lifetime. And sharks' ecological value is inestimable. Not only do they weed out sick and weak fish, leaving the fittest to breed, but as top predators they also keep other carnivores in check, preventing them from depleting the algae-eating fish that keep coral reefs healthy. Studies in the Caribbean have shown that where sharks are keystone species, their depletion could topple ancient food hierarchies and ultimately destroy the reefs.

IT IS A GREAT AND SAD IRONY that over much of the world sharks are prized foremost for the nearly tasteless cartilage ribbons, or "noodles," that make up their fins and are the costly key ingredient in shark-fin soup. As many as 73 million sharks die annually for their fins, which command more than $300 a pound in Asian markets. The trade is illegal and cruelly wasteful—finners often slice off the fins and throw the sharks back to starve, drown, or be eaten alive—but it continues to grow.

Add to the finners' toll the targeted as well as unintended take of millions of sharks by commercial fishermen, plus the slow reproductive rate of sharks, and grim outcomes loom. The oceanic whitetip, one of the most abundant sharks just three decades ago, is critically endangered in parts of its range because of relentless demand for its fins. The great white shark of Hollywood notoriety is believed to be in jeopardy worldwide. Even seemingly plentiful species such as lemons, bulls, and Caribbean reef sharks are threatened by fishing pressure and habitat loss. Scientists warn that many shark populations could be dangerously depleted within a decade, barring bold action. Large-scale bans on finning, more accurate reporting of sharks caught unintentionally, and establishment of marine sanctuaries could all help ease sharks' plight—as would a boost in research dollars. But without strict enforcement around the world, their numbers will continue to nose-dive.

In the Bahamas, commercial long-line fishing has been illegal since 1993, and shark parts cannot be exported from the country. Sportfishermen take some sharks, but demand for the meat is low. All this helps keep the blue waters a sanctuary for the blacktip, reef, and nurse sharks that vie for nibbles from nooks in the coral, for the oceanic whitetip on its global wanderings, for the great hammerhead rocking its bizarre snout side to side in search of prey.

But as developers make their way around the archipelago, shark habitat will continue to be whittled away. These big fish are magnificent in their own right and vital to the natural workings of this place. If the sharks go, so too goes a bountiful ecosystem that feeds local people and keeps outsiders coming back to the islands to fish, to dive, to write, to dream. □

Shark Tales Author Jennifer Holland writes about close encounters with sharks while on assignment in the Bahamas at **ngm.com/0703.**


Sleek reef sharks slip through
the blue shallows of the Bahamas
—their haven for now.
CARCHARHINUS PEREZI

rock of ages

In canyon country,
the depths of time are laid bare.

Reflections paint the walls of Clear Creek Canyon in Utah, one of the myriad massive canvases of the Colorado Plateau. Wrought from rock by wind and water since the dawn of the continent, the region — a maze of canyons, pinnacles, and mesas.

With an ominous rumble, a spring squall thunders down on Utah's Arches National Park, delivering a shot of the park's scant 8.5 inches of annual rainfall. Such storms are nature's bulldozers, tossing boulders in flash floods that scour the canyons with deadly force.

Some 180 million years ago, they were massive dunes formed from the sandy sediments of the eroding Appalachians, then repeatedly submerged by inland seas. Today, the sandstone layers of Coyote Buttes offer geologists ■ history book of the early Jurassic period.

Layers of water and algae curtain the rock face at Lower Calf Creek Falls in Utah. Fed in part by springs tapping a desert aquifer that holds water for decades, the falls persist through droughts. Such oases were critical to the survival of Native Americans and pioneers.

By Mike Edwards

Photographs by Frans Lanting

In the outback regions of the Colorado Plateau, time stands nearly still. Year by year, erosion lightly planes the mesas and deepens the canyons; a wet year thickens the sparse grasses and a dry year withers them. But the sea of painted rock covering vast stretches of Utah, Arizona, New Mexico, and Colorado remains much as it was before the pioneers, before the Spanish conquistadores, before the first immigrants to the New World.

Shift your timescale from the human to the geologic, though, and the story of these corrugated rockscapes isn't scant change but vast change, hundreds of millions of years of it. Geologists often speak of deep time, the great spans over which the subtlest forces can remake a landscape. The canyonlands are a textbook of deep time.

During epoch after epoch, the Colorado Plateau grew like a Dagwood sandwich, built with layers of sandstone, limestone, mudstone, and shale. These strata—the time-pressed cargoes of oceans, rivers, and winds—were hoisted, sunk, and twisted by violent tectonic forces. Volcanoes spread lava on them, wind and water attacked them, and one of the world's most readable geology lessons took shape.

Geologists began more than a century ago to trace the score of strata that parade across canyons and mesas and to give them names: Wingate, Summerville, and—among the thickest and most extensive—Navajo sandstone. Some 180 million years old, the Navajo was built layer by layer over 15 million years by wind-deposited sand. It is more than 2,000 feet thick in places, tinged anything from subtle pink to lurid orange by iron oxides and cut by countless canyons.

Where did so much sand come from? Much of it, apparently, from the Appalachian Mountains far to the east. Geologist Jeffrey Rahl and his colleagues found clues to its origin in tiny crystals of zircon embedded in the sandstone. Radioisotopes in Navajo zircons match those in zircons from the Appalachians, which were once as high as the Alps.

Presumably sand eroded from these peaks was borne westward by rivers, then swept by winds into a fantastic sand pile. At the time, the plateau part of North America is reckoned to have been somewhere near central Mexico, chugging north toward its present site at a few millimeters a year.

There's little evidence of life in the Navajo

Powell's Plateau

Sprawling across four states for 130,000 square miles, the Colorado Plateau is a classic example of erosional geology—a vast expanse of mostly sedimentary rock carved by the Colorado and other rivers. Geologist and explorer John Wesley Powell, who mapped the mazelike landscape, dubbed it the Plateau Province.

sandstone, but around 160 million years ago in the late Jurassic period, a new landscape began to develop—a panorama of forests, rivers, swamps, and inland seas, in which flourished dinosaurs, crocodiles, giant seagoing lizards, and huge sharks. Fossils of these monsters speckle the Morrison, Cedar Mountain, Dakota, Mancos, and Kaiparowits formations, built of sediments such as mud and carbonates.

Beside a road in Utah's Grand Staircase–Escalante National Monument, a gulch reveals the transition from the dry sands to the watery late Jurassic and Cretaceous environments in which life thrived. Atop the sandstone is a coal seam, the relic of a swamp. And above that a strip of hard-packed sand mixed with mud, the shore of an advancing sea. Next: a fossilized oyster bed—replete with fossil pearls, people say—laid down when the shifting shores had created a bay.

COMPARED TO THE GEOLOGIC record, the recent jottings of humankind in the plateau country seem faint indeed. Some of the bravest sagas, just a century or so ago, left hardly a trace. There was, for example, the party of Mormons, some 250 men, women, and children, who pushed into southeastern Utah in the snowy winter of 1879-1880, building a road along high ridges as they went.

Above the Colorado River at Glen Canyon they used ropes and chains to lower their 83 wagons down a skinny crevice they named Hole-in-the-Rock. Then, 1,800 feet below, they had to get their wagons and cattle across the icy river—300 feet wide there—and surmount a high cliff on the far side. They lost not a wagon in that crossing, and during the almost six-month odyssey their roster increased by three newborn babies.

Then came the hard part: farming and ranching the desert. Today some of the towns that pioneers raised in the plateau country have vanished and others look withered, affirming the observation of Wallace Stegner, peerless Western historian, who knew the Colorado Plateau well. "It is scenically the most spectacular and humanly the least usable of all our regions," he pronounced.

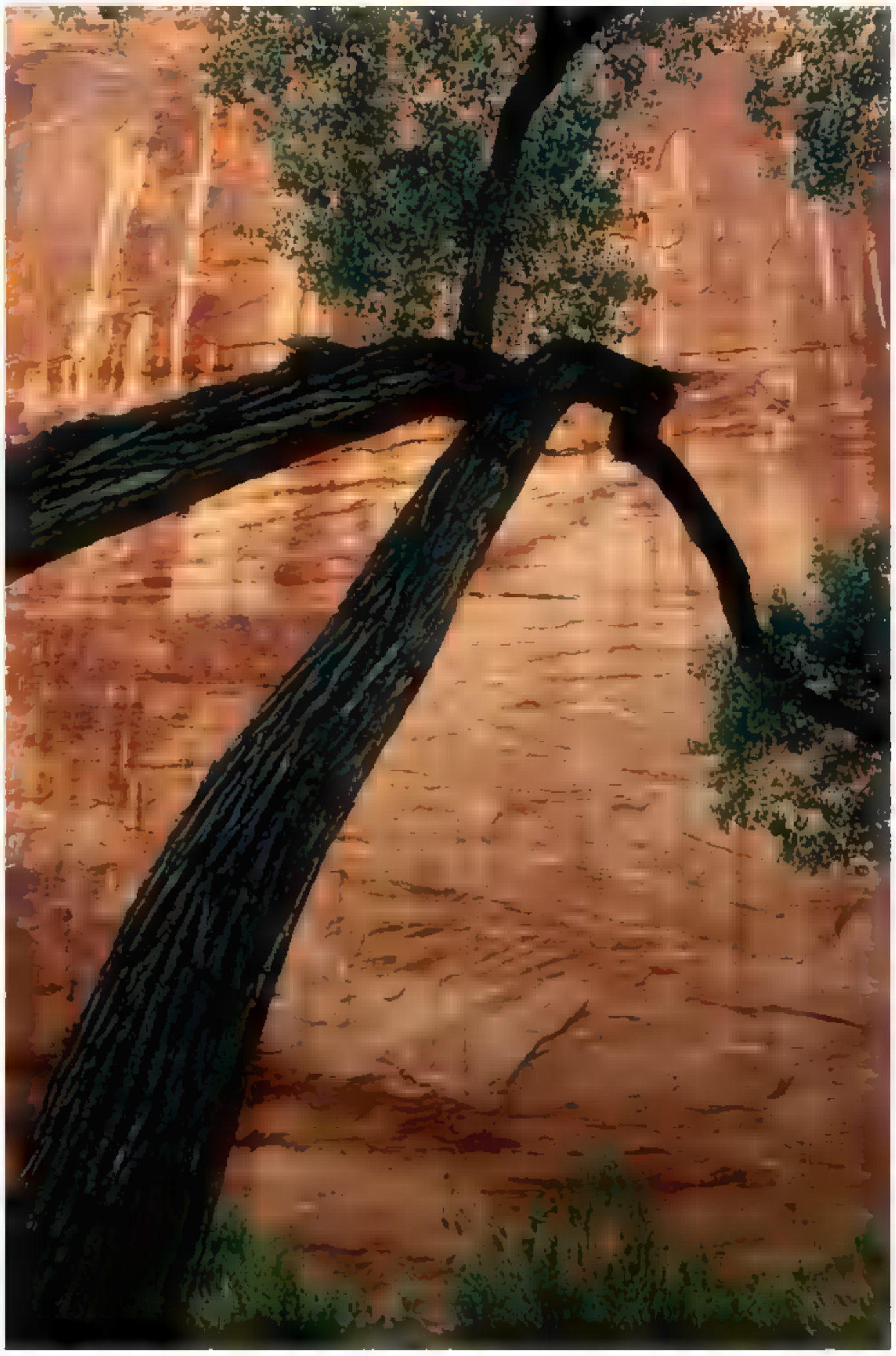
The forbidding rock itself beckoned during the years after World War II. Scattered in the formations were pockets of carnotite and pitchblende, uranium ores wanted for building Cold War arsenals and fueling nuclear power plants. Some of the uranium prospectors struck it rich; most didn't. Just about all of them melted away after the demand for uranium peaked during the 1970s, leaving a scatter of ramshackle

cabins, an occasional rusting truck, and piles of slightly radioactive tailings in melancholy testimonial to their quest.

Indians, too, left a record, including a pictorial one that can unnerve. Sometimes a hiker trekking beside a wall of sandstone feels a prickly sensation: Someone's watching. Then he sees a figure like a sentinel, painted on rock in ocherous red. And another. "What are you doing here?" they seem to say. "We were here first."

Such figures—often larger than life-size—are found in hundreds of Utah sites. Some have no eyes. Some, no arms or legs. Perhaps they were deities. Archaeologists call this ghostly art the Barrier Canyon style, after a major art site in Canyonlands National Park. Little is known about its creators, hunter-gatherer cultures that left behind little but their art and are vaguely called Archaic people.

Minute paint flakes recently collected beneath two sites and subjected to radiocarbon tests indicate that the paintings could be as much as 8,500 years old. If correct, such dates would make this spooky art more than twice as old as most experts had thought. Archaeologists have reacted cautiously to the new dates, however; they generally want multiple datings to be sure.



Finding its own angle of repose, a Fremont cottonwood anchors the riparian ecosystem in a tributary of the Escalante River. Cottonwoods play host to hundreds of insect species.

Elsewhere in the canyon country, hundreds of stone canvases depict not only humans but also bears, deer, serpents, birds, and scorpions. Painted onto the rock or incised or pecked into the surface, they are the handiwork of more recent, better-known cultures, such as the Basket Maker, Fremont, and ancestral Puebloan. (This last is the name that's supplanting offense-giving Anasazi, which is said to mean "ancient enemies" in Navajo.)

Successive cultures are thought to have viewed the art they discovered on the canyon walls with wonder or fear. Today, visitors to the region's many parks and monuments regard the land itself with awe. But a few thoughtless jockeys of dirt bikes and all-terrain vehicles carve ruts that will last for decades, even centuries. And sometimes a knife-wielding vandal decides that a precious rock-art panel is incomplete because it doesn't bear his initials.

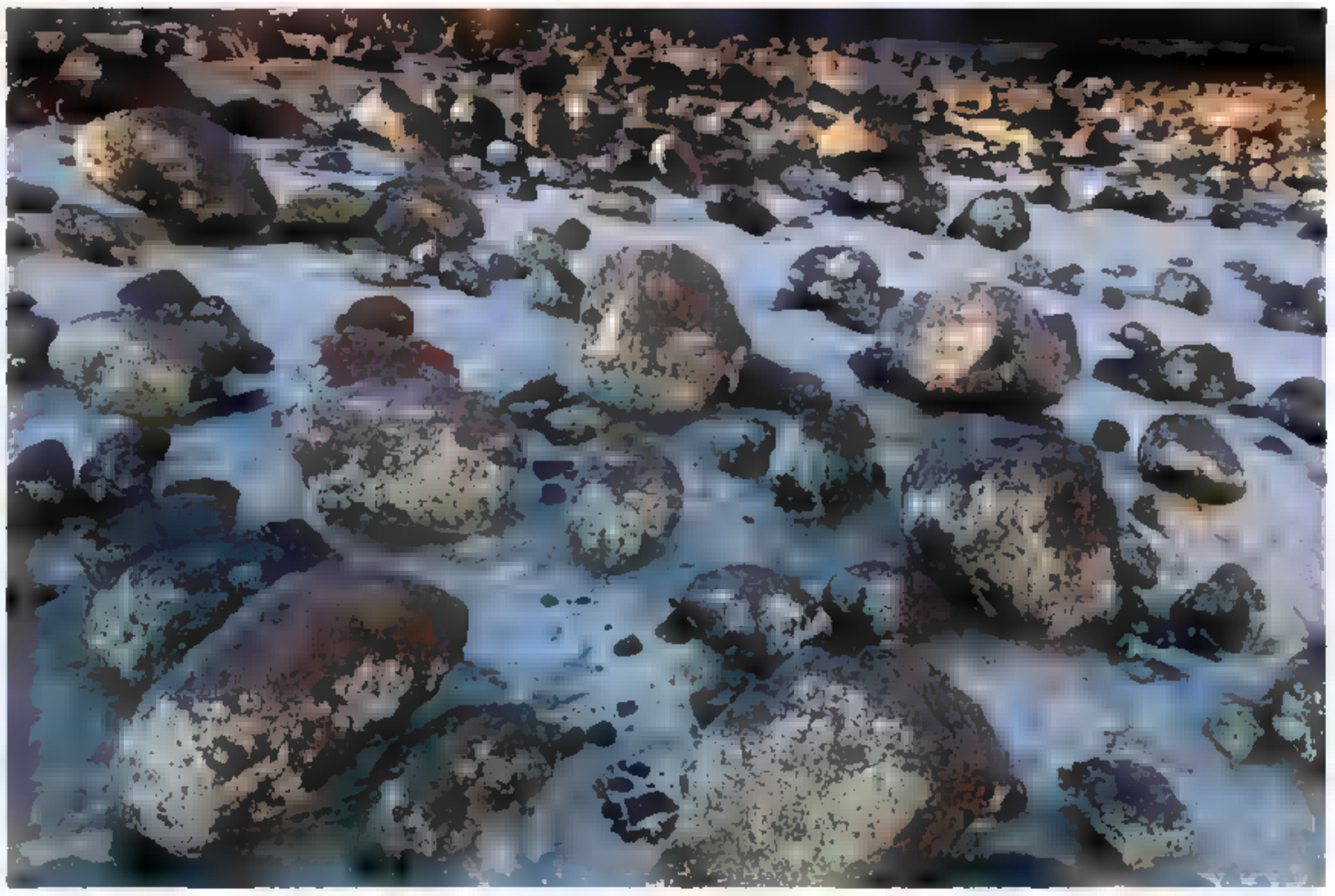
Meanwhile, the land writes its own story, ever so slowly. Pushed by tectonics, the realm rises a centimeter or so every year, while erosion takes a little off the top. Time marches on in canyon country, taking its own sweet time.

A nearly unbroken barrier almost 50 miles long, the Straight Cliffs tower over a sea of slickrock, sage, piñon, and juniper in Utah's Escalante watershed—a landscape that author Edward Abbey celebrated as "the place where the tangible and the mythical become the same."

Ghostly figures, some nearly seven feet tall, hover along the Great Gallery in a remote corner of Canyonlands National Park. Archaeologists believe hunter-gatherers painted the figures several thousand years ago, making them among the earliest North American art.

Time is the ultimate artist of the Colorado Plateau, its brushstrokes found on the 25-million-year-old volcanic rocks washed down Boulder Mountain (below) and in the tiny pointillistic details of a rock-loving lichen (bottom), perhaps centuries old. The symbiotic marriage of a fungus with algae or cyanobacteria, lichens create a tough, resilient ecosystem unto themselves that persists long enough to date historic earthquakes. Like a Georgia O'Keeffe painting a hundred feet tall, Antelope Canyon (right) is proof of what time, water, and sun—with rock as ■ medium—can do. □

Painted Rock Country Experience the color and sculpted splendor of the Colorado Plateau in our Photo Gallery at **ngm.com/0703.**



HOW TO HELP

This 19th-century Tiffany & Co. ivory thermometer was legally offered in a recent U.S. auction.

ZAKOUMA, PAGE 34 **Dying for Ivory** About half of Africa's elephants—600,000 animals—died between 1979 and 1990. Most were slaughtered for their tusks. Though commercial trade in new African ivory was banned by the Convention on International Trade in Endangered Species (CITES) in 1989, demand continues. Some ivory is actually legal. In the U.S., for example, it's permissible to import ivory older than a hundred years as well as personal trophies brought back by individual hunters. But without proper documentation, it's hard to discern legal ivory (left) from black market goods. "The best thing that people can do for elephants," says Luis Arranz, administrator of Chad's Zakouma National Park, "is never to buy ivory." Learn more about helping Zakouma's elephants—and hindering the ivory trade—from these websites:

- **Wildlife Conservation Society** Record amounts of illegal ivory were seized in 2005. Much came from the less patrolled areas of central Africa outside Zakouma National Park. Zakouma's elephants urgently need protection when they leave the park in the wet season. To help WCS fund this work in Zakouma—to pay for guards, better equipment, aerial surveillance, and collaborations with local communities also plagued by poachers, go to *wcs.org/savingelephants*.

- **African Elephant Conservation Fund** is administered by the U.S. Fish and Wildlife Service. It provides grants for elephant protection projects at sites including Zakouma. For information visit *fws.gov/international/afecf/afecf.htm*.

PHOTOS: MICHAEL NICHOLS, NGS PHOTOGRAPHER (TOP); NEAL AUCTION COMPANY

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An emergency landing that broke his plane's propeller couldn't stop Zakouma park administrator—and pilot—Luis Arranz.

ON ASSIGNMENT **Zakouma Hero** "The first time I saw a herd of elephants, I knew I wanted to keep them safe," says Luis Arranz (above) of the giants that gather in groups of 800 and more in Chad's Zakouma National Park. Arranz, a park administrator employed through the European Union, "threw all the infrastructure of the park behind us," says photographer Nick Nichols, who covered Zakouma's elephants with conservationist Mike Fay. Arranz himself piloted some 40 survey flights for Nichols to get the perfect shot of a massive herd. Says Nichols, "We can't do the kind of stories we do without people like this."

NG Spotlight

Emerging Explorer Josh Ponte never followed a straight career path. Before answering an ad for a gorilla project in Gabon, he worked in advertising, ran nightclubs, and restored 500-year-old buildings in his native England. Ponte found his true calling, though, in Gabon, helping set up 13 newly created national parks. "We wanted to take the news of the parks to the people and give them a voice," says Ponte, who started a public-awareness campaign through the Wildlife Conservation Society. "We came back with a treasure trove of information and music." With ethnomusicologist Ivan Lantos, Ponte filmed and recorded the little-heard and vanishing music, rituals, and traditions of remote rain forest communities. A documentary and CD of his work will be out this year.

PHOTOS: MICHAEL NICHOLS, NGS PHOTOGRAPHER (TOP); MARIA STENZEL

UNITED STATES DISTRICT COURT – DISTRICT OF MASSACHUSETTS

If You Made or Are Obligated to Make a Percentage Co-Payment or Full Payment for the GSK Drugs:

Kytril Injectable (Granisetron HCL)
Zofran Injectable (Ondansetron HCL)
or

Alkeran (Melphalan)
Kytril Tablets (Granisetron HCL)
Myleran (Busulfan)
Retrovir (Zidovudine)
Zofran Orals (Ondansetron HCL)
Imitrex (Sumatriptan)
Lanoxin (Digoxin)
Navelbine (Vinorelbine Tartrate)
Ventolin (Albuterol) or
Zovirax (Acyclovir)

A Proposed Class Action Settlement May Affect Your Rights. Medicare Part B Beneficiaries (or their Heirs) are Included

There is a Proposed Settlement with GlaxoSmithKline ("GSK"), one of the Defendants in a class action lawsuit pending in the U.S. District Court for the District of Massachusetts. The name of the lawsuit is *In re: Pharmaceutical Industry Average Wholesale Price Litigation*, Docket No. 01-CV-12257-PBS, MDL No. 1456.

What Is the Class Action Lawsuit About?

The lawsuit claims that certain drug companies reported false and inflated average wholesale prices ("AWP") for certain types of outpatient drugs. The reported AWPs are often used to set prescription drug prices that are paid by Medicare, consumers and insurers. The lawsuit asks the Court to award money damages to some people who paid or made co-payments for the drug.

What Individuals Are Class Members?

There are two sub-Classes for individual consumers who paid for the GSK Covered Drugs listed above.

- You are a member of the **Medicare Co-Payment Class** if:
  You made or are currently obligated to make a percentage co-payment under Medicare Part B for any of the GSK Covered Drugs listed above (or are an heir to someone who made such a co-payment) from January 1, 1991 to January 1, 2005. You are excluded from this Class if you made flat co-payments, or you were reimbursed or have the right to be reimbursed in full for your co-payments.
- You are a member of the **Private Payor Class** if:
  You paid (or are currently obligated to pay) for any of the GSK Covered Drugs listed above outside of Medicare Part B, from January 1, 1991 to August 10, 2006 and

  Your payment was (a) for the full amount out-of-pocket, or (b) your payment was a percentage co-payment. You're **not** included in the Class if you paid a fixed or flat co-payment.

What Are the Terms of the Settlement?

GSK has agreed to pay $70 million to settle these and other related claims. A $4.5 million payment to certain State Attorneys General, as well as attorneys' fees and the costs of administering the Proposed Settlement, will be deducted from the Settlement Fund before distributions to Class Members.

Thirty percent (30%) of the remaining fund will be distributed in cash to consumers who make valid claims. Seventy percent (70%) of the remaining fund will be set aside to pay the claims of insurer Class Members who submit a valid claim and other insurers who are members of a separate and independent group of Third-Party Payors (referred to as the "Independent Settling Health Plans" or "ISHPs") who have agreed to settle their claims against GSK for a portion of the Settlement funds.

Who Represents Me?

The Court has appointed attorneys to represent the Classes. Class Counsel will request that the Court award attorneys' fees not to exceed thirty-three and a third percent (33.33%) of the Proposed Settlement Fund, plus reimbursement of expenses. You may hire your own attorney, if you wish. However, you will be responsible for that attorney's fees and expenses.

What Are My Legal Rights?

- **If you wish to remain a member of both Settlement Classes**, you do not have to do anything. But, to share in the Settlement Fund you must file a claim as discussed below. If the Court approves the Proposed Settlement, you will receive the benefits of the Proposed Settlement. You will also be bound by all the Court's orders. This means you will drop any claims you may have against GSK that are covered by the Settlement.
- **If you wish to file a claim,** you must complete a Claim Form. You can get a Claim Form by contacting the Claims Administrator in writing, at the address given below, or by calling the toll-free number. It is also available on the GSK Settlement Web site. Claim Forms must be signed and postmarked no later than **May 28, 2007.**
- **If you do not wish to be a member of either or both of the Settlement Classes**, you must sign a Request For Exclusion form as outlined in the *Notice of Proposed Class Action Settlement*. Your request must be postmarked no later than **May 27, 2007.**
- **You can tell the Court if you do not like this Proposed Settlement** or some part of it if you do not exclude yourself. To object or comment, you must send a letter that is mailed and postmarked no later than **June 22, 2007**, as outlined in the *Notice of Proposed Class Action Settlement*.

Will the Court Approve the Proposed Settlement?

The Court will hold a Final Approval Hearing on **July 19, 2007** at 2:00 p.m. to consider whether the Proposed Settlement is fair, reasonable, and adequate and the motion for attorneys' fees and expenses. If comments or objections have been received, the Court will consider them at that time.

For a Notice of Proposed Class Action Settlement and a Claim Form

Call toll-free: 1 888-568-7645 (Se Habla Español) or Visit: www.GSKSettlement.com

Or Write: GSK AWP Litigation Administrator, c/o Complete Claim Solutions, P.O. Box 24743, West Palm Beach, FL 33416

ON ASSIGNMENT

A Fan of the Fins

Underwater, a photographer's strobe light is just another glimmer. During a shark feeding frenzy, says Brian Skerry, it looks a lot like bait. "I got nibbled a few times," recalls the photographer for this issue's "An Eden for Sharks." But in 30 years of photographing sharks in places like New England, Australia, and French Polynesia, Skerry has never been injured by his subjects. He relies on a healthy respect for the predators—and every once in a while, a cage. "I want to peel back the layers of myth about sharks," he says, "but I can't ignore the fact of danger. Sharks have evolved to be supreme. They are absolutely perfect for each marine ecosystem they inhabit."

Brian Skerry gets in the middle of the action at a Nassau dive resort designed for close encounters with sharks.

March Contributors

LAST STAND IN ZAKOUMA, page 34

J. Michael Fay and photographer **Michael Nichols** have spent much of the past 14 years documenting the life and land of central Africa. Their book chronicling that time, *The Last Place on Earth,* was published by National Geographic Books in 2005.

BIG BANGS, page 78

Ron Cowen is a staff writer for *Science News* specializing in astronomy. In addition to stars, he's fascinated by the history of recorded sound and collects antique cylinder phonographs.

ORLANDO, page 96

T. D. Allman is the author of *Miami: City of the Future, Unmanifest Destiny,* and *Rogue State.* His next book, *Finding Florida,* explores Florida's meaning for America.

David Burnett co-founded Contact Press Images, ■ photojournalism agency that celebrates its 30th anniversary this year.

AN EDEN FOR SHARKS, page 116

Jennifer S. Holland swam with six species of sharks for this story, usually without a protective cage. The senior writer quickly earned a new nickname around the office: Sharkbait.

Brian Skerry specializes in photographing marine wildlife in a range of habitats from polar ice to coral reefs. His last feature for the magazine was "Beneath Irish Isles," published in the March 2005 issue.

ROCK OF AGES, page 138

Mike Edwards is one of the most prolific GEOGRAPHIC writers ever. This month's piece on the Colorado Plateau marks his 55th.

Frans Lanting's *Life: A Journey Through Time,* ■ book and orchestral performance, has now been produced as an educational website: *LifeThroughTime.com.*

Tales From the Field Learn more about our contributors in Features at **ngm.com/0703.**

PHOTO: MARK CONLIN

ATTENTION

Have you ever had auto insurance with Farmers?

If so, your rights may be affected by a proposed settlement and you may be entitled to a cash payment, but you must submit a claim form to get it.

If your car or truck was insured by Farmers Insurance Exchange, Mid-Century Insurance Company or any other affiliated company ("Farmers"), was damaged in an accident and you made a claim with Farmers, a class action settlement may affect your rights.

There is a proposed settlement of a class action lawsuit involving Farmers' specification of certain "non-OEM" car and truck parts that the lawsuit alleges do not meet the quality standards required by Farmers' automobile insurance policies. "Non-OEM" car and truck parts are generally the sheet metal exterior of a car or truck, such as hoods and fenders, that were not made by, or for, the vehicle's original maker. That is, parts that were not made by companies such as GM, Toyota, Volkswagen or Ford. A Notice explaining all of the benefits available under the settlement, including how you can receive cash if you qualify, is available at the website shown below.

To receive a claim form and more information, call toll-free 1-877-576-9983 or go online to www.FarmersPartsCase.com

If you are eligible, you will receive $40.00 for each eligible hood specified by Farmers for any claim you made following an accident from June 15, 1996 to November 1, 2006. You will also receive $20.00 for any claim you made during the same period for each of the following parts that are eligible:

Fenders	Box sides
Door shells	Body side panels
Quarter panels	Tailgates
Rear outer panels	Lift gates
Truck beds	Metal bumper absorbers
Deck lids	Metal bumper reinforcements
Trunk lids	

Information About Your Warranty from Farmers. You will also receive information about the warranty Farmers provides for each non-OEM car and truck part listed above.

If you are a member of the proposed settlement class, you also have the right to ***exclude yourself from this settlement, object to this settlement, seek leave to intervene in the lawsuits***, and exercise other important rights. These rights must be exercised by **April 17, 2007**.

FLASHBACK

Before the Magic Kingdom Testing a movie camera in 1923, 21-year-old Walt Disney (above) had just arrived in Hollywood with ■ Mickey Mouse–size bankroll and Dumbo-size dreams. Rejected by the big studios, the young animator started his own business, conceiving a character that changed his fortunes forever. But Disney didn't draw the mouse that launched his empire; longtime collaborator Ub Iwerks gave form to Mickey, while Disney squeaked the mouse's friendly falsetto. "I never did believe I was worth anything as an artist," said Disney in the August 1963 NATIONAL GEOGRAPHIC. "I certainly don't consider myself a businessman." *—Siobhan Roth*

Flashback Archive See all the photos plus e-greetings at **ngm.com/0703**.

PHOTO: WALT DISNEY PRODUCTIONS

NATIONAL GEOGRAPHIC (ISSN 0027-9358) IS PUBLISHED MONTHLY BY THE NATIONAL GEOGRAPHIC SOCIETY, 1145 17TH ST. NW, WASHINGTON, DC 20036-4698. $34.00 A YEAR FOR U.S. DELIVERY, $6.00 PER SINGLE COPY (INCLUDES POSTAGE AND HANDLING). IN CANADA, AGREEMENT NUMBER 40063649, RETURN UNDELIVERABLE CANADIAN ADDRESSES TO NATIONAL GEOGRAPHIC, PO BOX 4412 STN. A, TORONTO, ONTARIO M5W 3W2. UNITED KINGDOM NEWSSTAND COVER PRICE £3.85. PERIODICALS POSTAGE PAID AT WASHINGTON, DC, AND AT ADDITIONAL MAILING OFFICES. POSTMASTER: SEND ADDRESS CHANGES TO NATIONAL GEOGRAPHIC, PO BOX 63002, TAMPA, FL 33663-3002. MEMBERS: IF THE POSTAL SERVICE ALERTS US THAT YOUR MAGAZINE IS UNDELIVERABLE, WE HAVE NO FURTHER OBLIGATION UNLESS WE RECEIVE A CORRECTED ADDRESS WITHIN TWO YEARS.

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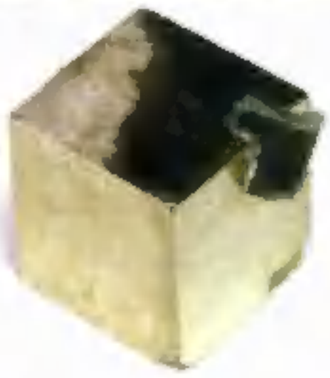
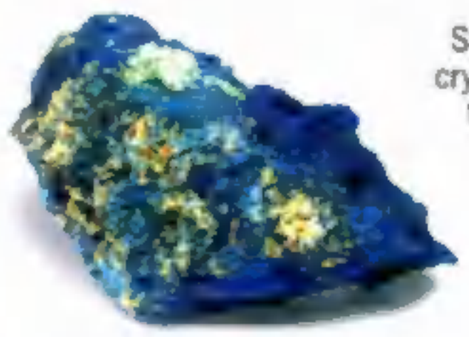


IRON PYRITE
From the Greek, "stone which strikes fire," refers to the sparking produced when iron is struck by a lump of pyrite. Has unique metallic luster and perfect cubic form.



AZURITE
Sharp, dark blue, crystalline mineral found in copper ore deposits in North and Central Africa.

OF THE EARTH

ROSE QUARTZ

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INSIDE GEOGRAPHIC

NATIONAL GEOGRAPHIC CHANNEL

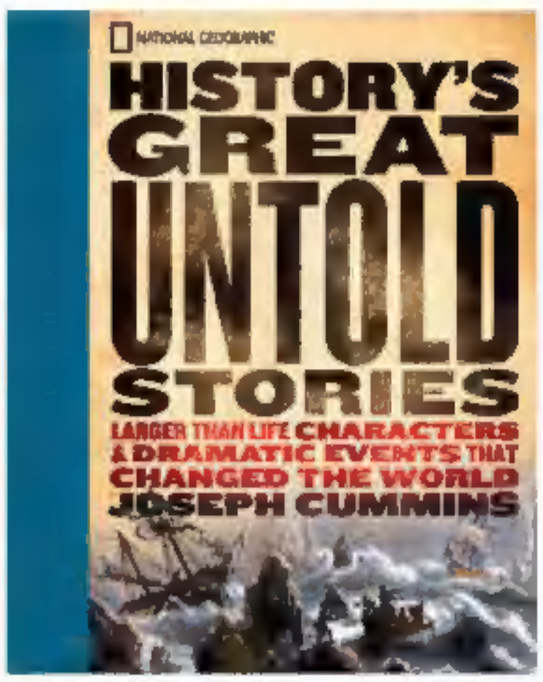
Galápagos The islands that Charles Darwin made famous teem with unique wildlife. Marine iguanas (above) brave the ocean for food, giant tortoises lumber across volcanic debris, and blue-footed boobies court on this volatile archipelago. This month National Geographic Channel takes a three-hour high-definition journey across reefs, rocks, and islands. *Galápagos* is one of the most in-depth and comprehensive films ever made about this remarkable place.

NG MAPS Old Maps Newly Available

National Geographic Maps, in collaboration with Maps.com, has put its archives online. Take a look at an 1891 map of Alaska—one of the first the GEOGRAPHIC ever published. See national alliances during World War II in this 1943 world map (above). But it's not just history: Our recent cartography is also on view. To explore the full collection, go to *ngmapcollection.com.*

NG Books

History's Great Untold Stories What led Japan to close its borders for more than a century? Who pioneered the idea of peaceful protests? Some of the most important stories are rarely told. This book, available now at bookstores, examines 28 events that changed the course of history ($30).



Jewish Heritage Travel Ruth Ellen Gruber's guidebook offers a tour of some of the most important Jewish heritage sites in eastern Europe. Weave through 15 countries, exploring culture through the cemeteries, synagogues, Jewish quarters, and more. The book also provides information on museums, monuments, and festivals ($18.95).

PHOTO: TUI DE ROY, MINDEN PICTURES (TOP)

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